

AVIATION WEEK

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APRIL 11, 1955

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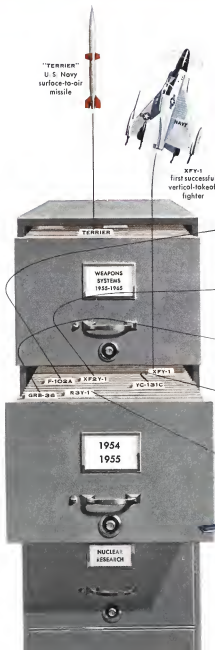
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extreme accuracy in fuel metering to maintain their high performance ratings and at the same time control operation within satisfactory limits. Through a system of accurately measuring flow separate sensors, the Holley control automatically meters corrected fuel flows to the engine in accordance with the engine operating requirements.

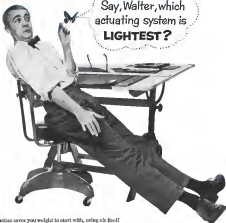
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NEWS DIGEST

Domestic

Atomic warhead on an air-to-air guided missile was exploded over Nevada Apr. 6 in the first test of this type. The nuclear weapon was launched from a Convair B-36 at a pattern of smoke trails led down at 40,000 ft by six North American F-86s. Atomic Energy Commission and the Defense Department said the nuclear-armed missile is capable of delivering a load of bombers without a direct hit (AW Apr. 4 p. 16).

Initial flight of North American Avionics' first production FJ-4 Fury was made last week, five months after the prototype was flown. The Navy carrier-based fighter, powered by a Wright J65 turbojet, is capable of speeds in excess of 600 mph.

First delivery of Fairchild F-274 to the Air Force will be made in May to the 46th Troop Carrier Wing at Andrews AFB, Okla. Fairchild has an Air Force contract to build more than 170 F-274s.

New York Supreme Court instructed the Port of New York Authority to act from making further space allocation at Idlewild International Airport's \$60-million terminal and a decision is reached on motions filed Apr. 5 by National Airlines and PNYA. NAL asked for a temporary injunction halting the terminal's construction. The Port Authority requested a summary judgment.

Precision Aviation Corp. received a \$1.5 million contract from Douglas Aircraft Co. for 300 gal jettable fuel tanks that can be installed on such aircraft as Navy's F4D-1 and the AD series. The Los Angeles component manufacturer also received a \$250,000 contract from Lockheed Aircraft Corp. for quartz plates.

Trans-Union, a unit of 300,000 sq ft, 46 miles, set by the U.S. Civil Liberties Review in a Republic F-84F flight from Los Angeles to New York Mar. 9, was recognized by the National Aeronautics Association as the official transcontinental speed record. Speed dipped more than 30 mph off the previous official record set by a North American F-84F last year by Col. Wilfred W. Moister. It has adjusted time and speed also but set the unofficial record set in 1954 by a flight of Grumman F9F-6s.

Florida Helicopter Corp., Maitland, Fla., granted an average wage increase of 5.5 cents Apr. 4 to 1,915 hourly rated employees.



Convair VTOL Flies on the Level

Convair XFY-1 Navy fighter levels into horizontal flight after a vertical takeoff near San Diego, Calif. Portion of the VTOL plane's fuselage, wings and tail in flight with take for on-foot studies. Additional information is being added on the experimental fighter at Convair San Diego plant. XFY-1 is powered by an Allison T-40.

International

FZV-3 Neptune anti-submarine patrol bomber powered by two Wright J46B turbo-propellers, is being delivered to the Navy in quantity by Lockheed Aircraft Corp.

Douglas Aircraft Co. is preparing to demonstrate application of closed-circuit television to optical tooling used in DC-7C production.

Alcauld Products Division of Kerosene Co., Niles, Mich., secured a contract to produce special and subsea aircraft for Boeing Aerospace Co.'s KC-135 jet tanker.

Financial

Boeing Aerospace plans to sell 56 million in common stock and negotiate a \$15 million long-term institutional loan to deliver the cost of seven DC-7Cs ordered from Douglas Aircraft Co.

Glenn L. Martin Co. will ask stockholders Apr. 25 to approve an increase in authorized capital stock from 3 million to 6 million shares of \$1 par value.

Boeing Aircraft Corp., Wichita, is closed a 10-cent dividend on common stock, payable Apr. 26 to holders of record Apr. 14.

East Germany plans to start rebuilding its aircraft plants next year under the Soviet satellite's second five-year plan despite pressure. Walter Ulbricht announced last week. Factories in East Germany include the Junkers plant at Dessau and the Heinkel works near Rostock. In West Germany, about 300 aircraft parts manufacturers hope to resume production after June 1.

KLM Royal Dutch Airlines ordered 10 DC-7Cs from Douglas Aircraft Co. for international service. Deliveries of KLM's Seven Seas will begin in the spring of 1957. Approximate value of the order, including spares: \$70 million.

Vickers Viscount was ordered by the Pakistan government for the country's government, bringing Vickers-Armstrong's total orders for the turboprop transport to 150.

French Air Force purchased four twin-engine Super 18 turboprops from Boeing Aircraft Corp., increasing its fleet of Beechcraft planes to about 44.

British European Airways reports the 100,000th passenger to fly in the Airbus's Vickers Viscounts boarded a turboprop-powered transport Apr. 6 at London.



TITANIUM helps lift the C-130 higher and faster...with heavier payloads

Titanium is an essential material for high-performance aircraft. On the new Lockheed designed Air Force C-130 turbo-prop medium combat transport, titanium's high strength-to-weight ratio... exceptional resistance to corrosion... and freedom from stress corrosion cracking, play a vital role.

Lockheed uses REM-CRU A-88 and A-10 extensively in the C-130's power plant components—fire walls, shrouds, cabs, longons, and

skins—where outstanding properties are needed at elevated temperatures.

REM-CRU, pioneer in titanium alloys for advanced aircraft applications, has substantially expanded its facilities. Now you can be sure of the availability of the REM-CRU titanium grades, sizes and shapes to meet your needs. And for help with application or fabrication problems, REM-CRU's engineering staff is always at your service.

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Washington Roundup

Mail Rate Plan

Domestic breakbulk mail rates have been fixed at a new mid-rate level after plan agreed upon by the airlines and the Post Office Department which is expected to save the Post Office more than \$5,000,000 a year. The agreement was reached after long negotiations, and after hearings had been started by the Civil Aeronautics Board.

The plan is similar to one proposed by CAA last September designed to save \$3,239,800 a year. It is based on a rate plus what rights and pay on an 80-20 basis between line haul and terminal charges. Last year the airlines got \$35,000,000 in savings and per pound of rates ranging from 45 to 75 cents a ton-mile. Under the new rate, pay for the same period will be \$27,500,000 at a rate that averages 35.55 cents a ton-mile.

The breakbulk rate has been open for more than a year, and the new rate will be retroactive to that date. The new rate will be retroactive to that date. The new rate will be retroactive to that date. The new rate will be retroactive to that date.

Hurdles met by the plan will be the Big Four (American, Eastern, United and Trans World), whose rate pay will drop 18% because of their long haul routes. They will drop for all carriers but Northwest Airlines, which will get a slight increase.

Fleet for NATO Fighter?

Latest rumor on the NATO lightweight fighter competition is that Italy's Fiat factory at Turin will get contract for first quality of aircraft, but Portugal appears to want the decision a bit later, that there will be an awarded more. Purely apart from USAF, which is counting since because purchase will be financed by American money through defense procurement program, a firm in its opposition to Fiat deal. USAF takes the position despite the fact that the Fiat entry is strongly supported by Gen. Lauris Norstad, Air Depot, Supreme Allied Commander, Europe.

ARDC: Round Two

Watch for hot protests from Maryland's congressional delegation over USAF decision to move Air Research and Development Command headquarters from Dayton, Ohio, to Dayton. So far, neither the congressman nor the press have been able to uncover Secretary of Air Force Harold G. Tibbitt's reasons for the shift (AW May 21, p. 13). In letters to congressmen, Secretary Tibbitt says the move will be made in 1956, that it is for reasons of economy and that the decision was made after an independent study and review by a firm of industrial engineers.

Marked congressional support means a largely political, possibly linked to the struggle between ARDC and Air Materiel Command for control with move designed to bring the Materiel operation closer to the government center. Senators and representatives will enter debate over authorization of funds for the shift to Dayton amid a long-term report of a committee headed by Lt. Gen. James H. Doolittle. The dissent from the reason why Baltimore is a good site, and is signed by senators Carl Overberg, Mirvis J. Kelly, Loren N. Rodman and A. E. Lumbard, Jr., in addition to

Sen. Doolittle and three USAF colonels.

House Committee on Government Operations has been asked to study study of situation and the Maryland delegation seeks a chance to appear before the appropriations committee. Big stake to politicians 1,000 jobs in Baltimore, with payroll near \$1 million a month.

ATA Search Continues

Air Transport Assn's search for a successor to Earl D. Johnson in president has been extended. Johnson is now set to leave the 542,000 a year post Apr. 10 in his General Dynamics is vice president. He originally hoped to stay with the ATA but his resignation had been selected but after four months of waiting Johnson can no longer delay his move.

Difficulties of ATA's based on locating the right man for the top executive post in two field lack of unanimity in any one property and setting the right man. It was there were before they agreed on Johnson. He turned down a contract and then of his earlier who are now being approached also refuse a long term contract.

Praise for Tolbert

The most enthusiastic praise from Senate appropriations committee went to Secretary of Air Force Harold Tolbert—not of the top cabinet of defense officials and officers participating in briefing sessions before the group (see p. 16). Praise came from Sen. Margaret Chase Smith, who thought Tolbert was "a very human person," and from Sen. John Stennis who awarded on "the splendid job" he has done in USAF head.

Although there have been initial differences of opinion between USAF's military and civilian commands, Tolbert did the country that "there has been some loss of time when we (Tolbert and USAF Chief of Staff Gen. Nathan Twining) did not agree on procedure when the matter cleared away."

New NACA Facility: Where?

There are more indications that the \$4.5 million facility for testing the effects of radiation on aircraft materials and components may become entangled in a tug-of-war as to where it is to be located.

NACA wants it situated near the Lewis Flight Propulsion Laboratory in Cleveland, Ohio, to eliminate the bookkeeping expenses of a new station. A consulting firm is now making a survey of possible sites in the area. But House Sen. Herman Welker opposes that Cleveland is a key strategic point and that the project should be situated in a state strategic point such as a site in Idaho.

MATS Report Response

House Committee's report on the Military Air Transport Service was enthusiastically received by both the domestic and international scheduled airlines (AW Apr. 4, p. 14). Industry reaction was centered on the recommendations that the government make greater use of available commercial air services. The emphasis is to eliminate government competition with private enterprise in carrying commercial-type air traffic for the military establishment to the commercial airlines and restricting MATS operations in that category.

—Washington staff

Defense Compromises in Tacan Dispute

Secret agreement with Commerce Dept. to head off Congress' investigations may set off new inquiries

By Freddie Staver

A secret compromise agreement between Department of Defense and Department of Commerce, Aviation Week has learned, may upset two months of congressional efforts to resolve the civil-military differences over a common system of an navigation (AW Apr. 4, p. 15).

The dispute was noted by the Air Navigation and Development Board's recognition in favor of the military's Tacan over civil VOR/DME for the common air navigation system.

The military, which had made a strong case for its position as Tacan, suddenly decided to back down. The action seemingly would satisfy Tacan's opponents, but possibly will create a more explosive situation. It would provide the side-by-side comparison of two expensive and conflicting systems, putting off the decision on a single system for another five years. Congress is determined to settle the issue now.

The Defense Department's goal is to head off a part congressional investigation of Tacan. The action will probably result in a full-scale investigation.

■ **Congressional Study**—Congress has under two investigations aimed at preventing a final decision through its final appropriations power. Reaction of Congress to additional confusion isn't certain, but there is no question that Congress does not intend to continue financing two systems.

The ANDB decision gave the legislative branch a starting point for the first time in five years. Once the matter was brought into the open, the legislative committees closely studied the Tacan-VOR/DME dispute.

Fishers of the executive branch to consult the legislative and agencies have conversations at this time may be disastrous. At least one group, the transportation subcommittee of the House Commerce Committee, is now a decision after an extensive study of the matter.

■ **Compromise Program**—Apparently in response to the pressure of a congressional solution, the military began a series of conversations designed to produce a compromise and expose further investigation. A five-point program to

modify the ANDB position was evolved.

- **Continue the operation of civil DME** until June 30, 1990, implementing the ground installation of DME to such limited degree in this period of operation would qualify.
- **Least DME** to force them the full civilian completion, if this is found to be feasible.

- **Final purchase of airborne DME** equipment to wait off the cost within five years and seek legislation to this effect if necessary.

- **Obtain funding of military government agencies** for this modified position and work in good faith toward the satisfaction of the common program, along these lines at the earliest date consistent with resolution of present uncertainties, completion of the dual-

system of the equipment, and availability of equipment for common system use.

- **As a military** to the dual point DME operations will be discontinued June 30, 1990, if required by standardization of Tacan. All purchase of DME equipment should be on notice of the likelihood of this action.

This proposed trade-off is in the interest to proceed with full development of Tacan for eventual adoption as the common system but would extend the "experimental" period for DME by five years.

Armed by Congress and Air Coast Quarters Committee after that work, on the contrary as:

- **Have appropriate** administrative arrangements in the Civil Aeronautics Administration's budget for the five years, which includes a program for 55 additional DME ground stations.

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- **Coordinate** with the Air Coast Quarters Committee will receive a report from the Navigation Panel, which was authorized to review the ANDB recommendations and appear there at an event of Department to suggest alternatives.

Military Plane Fund Balance \$0.8 Billion

With new order bringing total \$5.7 billion during the first eight months of fiscal 1995, Air Force and Navy had an uncommitted balance \$0.8 billion and related percentage of more than 55.5 billion.

USAF obligated \$5.1 billion during the eight-month period, five Navy, \$625 million. The unobligated balance, as of May 1, was divided: USAF, \$6.4 billion, Navy, \$2.5 billion.

The unobligated balance of funds for aircraft and related procurement of the two services on that date was \$21.2 billion: USAF, \$14.1 billion, Navy, \$7.1 billion.

Expenditures of \$5.6 billion during the first eight months of fiscal 1995 was slightly less than the \$6 billion expended for the same fiscal 1994 period. The \$200 million difference was due to reduced spending by the Navy.

Red China Gets Jet Fuel

(McGraw-Hill World News)

Sheng Kong—Communist China is getting longer fuel for its Ramjet-built MIG jet fighters through the black market and under shipment from Soviet satellites. Authorities here report figures from Red China on purchasing black market kerosene at prices ranging from 1950 to 1975 more than the regular United States cost of 25 cents per gallon.

The Sheng Kong Standard says the Peking state agency recently ordered a cargo of about 10,000 tons of jet fuel and petroleum—enough for more than 3,200 MIG sorties against Taiwan—at Whampoa Harbor near Canton.

Four Communist Indian Kennedy were among illegally from Canton, Kowloon, to Long Spine and Whampoa Harbor, the newspaper says. Two of the tankers were owned by Nationalist China but were.

According to a United Press report from Taipei, the China News agency in unclassified Peking letter landed 8,000 tons of jet fuel at Whampoa May 21.

Evaluation Proves Tacan Accuracy, ANDB Chief Tells Avionics Group

By William Gough

Los Angeles—Evaluating changes in Tacan, the military, short-range navigation system, have shown it will fulfill its duty purpose, according to Col. J. Francis Taylor, Jr., director of the Air Navigation Development Board. Col. Taylor told the meeting of the Radio Technical Commission for Avionics here that the evaluation tests were made at Colwell and Natick, N.J.

Taylor defined Tacan as being slightly less accurate in distance than the common system DME and considerably more accurate in bearing than VOR. Part of the accuracy of the bearing system is inherent in the equipment and part because the height of the antenna is so low that the bearing is less critical, and the over-water performance of ground equipment is less critical.

■ **Easy Comparison**—The engineering evaluation at Colwell and Natick modified UNK-1 ground and ARN-24 airborne equipment. The Colwell site is in the common system, a common VOR/DME facility, making it possible to compare Tacan error data with smaller data bases on the VOR.

■ **Easy Comparison**—The engineering evaluation at Colwell and Natick modified UNK-1 ground and ARN-24 airborne equipment. The Colwell site is in the common system, a common VOR/DME facility, making it possible to compare Tacan error data with smaller data bases on the VOR.

■ **The average Tacan error data** showed a spread that varied from 0.6 deg. to 1.4 deg. for elevation angles from 5.1 deg. to 6.9 deg. Corresponding VOR data for the lowest part of the elevation angle range showed a spread of less than 0.4 deg. to 0.4 deg.

■ **No severe tracking** was observed at any elevation angle with the Tacan equipment. The average random error spread of individual readings was about 0.4 deg. The maximum error spread showed a spread of about 1.5 deg. Corresponding VOR data showed tracking spread of from about 0.5 deg. to over 1 deg.

Large random error data for the Colwell Tacan equipment showed an increase in the error spread over that of the small random error, Taylor said. He attributed increased spread, in part, to decreased signal level and to increased error in determining actual bearing.

At Natick, spread of 1.4 deg. was observed on the 17 m. error and 1.4 deg. on the 30 m. error. The corresponding large random error data for the Colwell VOR equipment showed an average error spread of 1.5 deg. to 3.1 deg. for the same bearing.

■ **And Tacan** is less critical in its requirements for wiring than a VOR. Taylor and bearing accuracy in the presence of reflecting objects appear to be less critical, but the height of the antenna for ground equipment is less critical, and the over-water performance of ground equipment is less critical.

■ **Taylor also reported** that the Navy's development of Tacan, a much smaller, more accurate, and it can provide the total number of interference-free channels required for common system operations.

■ **VOR**, Taylor said, because terrain, man-made obstructions, and other factors installed on Navy carriers.

■ **VOR/DME** does not meet military needs for equipment which can be used, said in military theater of operations.

■ **Declassification**—Declassification of the disputed military. Tacan equipment is not likely to take place any time, Col. Taylor said.

■ **Not in proceeding** at a reasonably early date of declassification cannot yet be announced, 3 am replied to say that there is apparently nothing in the way of declassification except the complexity of the procedure, said he said. "We hope an early announcement."

can be used concerning the five engineering details which are still under way.

■ **Taylor emphasized** that security was overriding development of Tacan was not entirely to military requirements. It was not an intention to be controlled, developed in secrecy because it was competitive to the VOR/DME," he said. "It is definitely not intended in the beginning, as others have suggested, that it would be offered for common system use."

■ **There was** no thought as the military that I have been able to discover or that I was aware of at that time through personal knowledge of Air Force data, that the military would be considered in common system use. On the contrary, it was to be a "military system" to be used in that operation or, in the case of the Air Force, in tactical operations.

■ **Both Air Force and Navy** had the idea that these flights within the limits of the United States would be conducted with common system navigation.

■ **Designed for Military**—The tactical system was therefore developed in accordance with the military's own special requirements in which the security aspect was vital," he explained.

■ **United States** might be the battlefield in the event we were changed the military concept, Taylor told the group.

■ **"It was** because apparent, and this is one of the most important results of the history, that the tactical navigation requirement for the military was so large compared to common systems but involved the United States as well.

■ **The rank** of these two changes is correct," Taylor said, "and that the Air Navigation Development Board was advised by the military that Tacan appeared to satisfy the \$0.8 billion requirement for common system navigation and the common coordination system and suggested it be put to this use. This offer was based again on the military indication that only one navigation system was used and be operated on in the United States and that it had to meet at least the common requirements of its most exacting users, the military."

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New Rocket Test Site

Airwest General Corp. will operate a new rocket engine test facility to be built by the Air Force at Fort Greaser, an Army base, in Arizona.

■ **Service and** this position, design a facility and construction of the plant will be started later this year.

■ **Selection of the Fort Greaser** site conforms to the ability of dispersing its facilities at this type.

Twining Supports Army Program For Increased Military Airlift

By Katherine Johnson

Army Chief of Staff Gen. Matthew Ridgway "shortly" will present to the Joint Chiefs of Staff a program to increase substantially the military airlift capability.

This was disclosed by Air Force Chief of Staff Gen. Nathan Twining at a meeting of top Defense Department officers and officials held at the Science Applications Center on the Fort Belvoir military base.

Indicating that an increase in planned airlift would have USAF support, which would move quickly support on JCS, Twining told senior staff Air Force considered this program very important and is ready to implement an expansion "as soon as we are given the green light."

• **North Pacific**—Gen. John Stennis, who has been designated to be the commander of USAF's airlift for Army ground troops, said "A few weeks ago I was told the same thing—that the plan for an increase would be submitted shortly to the joint chiefs."

Meanwhile, in a speech to the Senate Air Force, Sen. Stuart Symington, former Air Force secretary, declared that "if we should be forced again on this matter, despite all our confusion bawling about it, we would have to accept it."

At a later Air Force meeting, Twining said he had properly signed a single Army directive. And this despite the fact that he was formally pledged our allies to support them as the ground as well as in the air.

Under the new Science Applications' 137-wing program for the Air Force, the number of troop carrier wings was reduced by six from the 17

planned under the Truman Administration's 143 wing program.

• **Intelligence Problems**—Stipulating that there is not nearly enough information on military developments abroad the Joint Chiefs, although "everything humanly possible" is being done to improve intelligence, Twining highlighted these points in his report to the Science Committee.

• **The new Russian Type V medium jet bomber** which "have been openly displayed in countries which indicate that they may be an quantity production, are comparable in size, design, and estimated performance to our own B-57."

• **The new Type 17 long-range Russian jet bomber**, comparable in size to the B-57. "It is almost exactly in our dimensions."

• **The Soviets are now producing large numbers of an improved jet with better performance than the MIG-15**, he said. The MIG-15 is a fast jet engine, Twining said, and the engine fuel and acceleration of U.S. jets were the main reasons for our margin of air superiority in Korean operations.

• **Russian contributions to an aerospace buildup of Red China**, including more aircraft, is particularly significant in the light of the recent Far East tension.

"A potentially greater danger," Twining added, "is their expanding system of air bases. This increased base system gives the Communists the ability to move in directly against the Soviet Union. We cannot ignore their capability to double or triple their air strength in the Far East overnight."

• **USAF is placing the very highest pri-**

ority on development of an intercontinental ballistic missile as the best defense against such a weapon. "We know the Soviets are at work on an intercontinental ballistic missile," Twining declared. "We must assume that goal with this weapon is sufficient means to destroy targets in the U.S. ballistic missiles with intercontinental ranges present a defense problem more difficult than any ever faced in history. Thus will be at speeds above 10,000 mph. They can be launched from widely dispersed, isolated, well hidden firing sites. They would be difficult to find and destroy."

• **USAF is making good progress in development of intercontinental ballistic missile Atlas**. "It will be powered by rocket motors and develop speeds of several thousands miles per hour," Twining reported.

• **Observing that aerial refueling is only a partial answer to fuel endurance** in the Twining suggested "speedy progress toward our goal of unlimited range—the nuclear-powered airplane."

Air Defense

• **USAF will begin to equip interceptor squadrons with an air-to-air missile**, the Falcon, in the near future (AW May 21, p. 10).

• **USAF's surface-to-air missile**, the Thunder, designed to increase the intercept and destruction range between the capability of the Army's Nike, is now undergoing test and "we are pleased with the results so far," Twining said.

• **Construction of nuclear bomber units** from B-29s and B-50s will be completed by early 1955. The new USAF will begin to replace B-29s with B-57s in heavy bomber units.

• **Ridgway's Chairman of the Joint Chiefs of Staff**, Gen. Arthur H. Radford, has been looking to the administration's defense policy of giving "priority in all planning to our offensive capabilities with emphasis on our capacity to generate interest and overwhelming counter-offensive blows to any enemy who might attack us."

Challenges

Sen. Symington, a leading advocate of the strategic missile concept when he served as Secretary of the Air Force, challenged Radford's position as a four speaker. He said: "That position is logical during the past decade, when we had completely no such weapons, but that is no longer the case. Unless we reverse that trend on taking a stand on nuclear weapons, we will create a military force capable of doing what the free world is no other to get but not to do."

If the Congress and the military agree that to move into the Middle East, or in Asia, what do we do? Do we start a nuclear war? ... Is inducing

usability as ability to fight on the ground ... we may well be committing ourselves to a path from which there can be no turning back—world devastation resulting from the use of the hydrogen bomb."

Observing that U.S. security is inextricably bound with that of other nations, Radford maintained that these countries "can assist themselves, provide for their own and support countries the bulk of the defense ground forces and land and air power." The most effective contribution the U.S. can make to mutual security, he said, consists of complex technical systems and equipment, random air and naval power, and highly mobile offensive combat formations.

He observed that "we have reached a state where atomic weapons are now conventional and their use is being fully integrated into our strategy and tactics."

Chief of Naval Operations Adm. Robert Carney reported that in addition to a new Forestal-class cruiser, the Navy is fiscal 1955 shipbuilding program includes construction of two conventional powered submarines and three frigates with guided missile capabilities, installation of angled decks on six cruisers to gain improved performance from jet aircraft, conversion of one light cruiser and one destroyer to give them guided missile capabilities, conversion of 12 escort vessels and four Liberty hulls into guided missile ships in support of continental defense.

AEC Easing Industry Access to Atomic Data

Recognition of industry's growing interest in possible applications of atomic energy has resulted in legislation from Atomic Energy Commission controls over information on the subject.

Now is possible to get what amounts to a library card, granting access to material data that would be needed in potential applications of the new science of atomic energy. As of the present, granted on a "reasonable need-to-know basis," is "bureau agreement."

Policy changes, drafted by Charles G. Mink, acting chief of the Federal Atomic Energy Commission's Research and Development Commission.

For commercial interest is sufficient "need-to-know" in long as there is reason to believe there is ability to use the information.

AEC now realizes that service industries, such as insurance, finance and insurance organizations and trade associations, may need access to restricted data.



TRAINER FLIGHT: Unique comparison of new T2V-1 (foreground) over carrier TV-2.

T2V Uses Boundary Layer Control

• **Boeing's** T2V-1, Lockheed Aircraft Corp. took the wings off its new two place T2V-1 jet trainer last week revealing that a boundary layer control system will be standard equipment. The new aircraft now is going into production at the California Division.

The T2V-1 will be the first two-place jet trainer assigned to pilot training aboard aircraft carriers. It is an up-to-date version of the T2V-1 (USAF 151).

• **Boundary Layer Tests**—Installation of boundary layer control on the T2V-1 follows tests of a similar system on a Grumman F9F-4 Panther jet fighter. The F9F-4 test took place first time with boundary layer control some two years ago. It was designed by Bureau of Aeronautics, Allison Division of General Motors Corp. and Convair Aircraft Engineering Corp.

Test pilots A. W. Lewis and Rex Chiswell were testing the T2V-1 prototype at Lockheed's Palmdale facility.

• **Carrier Lift**—Purpose of the boundary layer system is to improve wing efficiency and prevent stall. The system is provided on from the T2V-1's Allison J35 engine is diverted into a tube inside the leading edge of the wing. It then is blown at high speed over the wing top and along it.

By moving the boundary layer flow over the wing to hug the air surface more closely, the effect increases lift and delays stall—making possible increased landing speeds and shorter take-off runs necessary for carrier operations.

Lockheed reports that landing speed of the 6000-lb. T2V-1 is 79 mph.

• **Engine, Airframe**—Provisions are made for both Allison J35 A-22 jet engine with 4,100-hp. thrust and the Pratt

& Whitney J85-P-8 with 7,250 lb. thrust. Production T2V-1 will be powered by the Allison engine.

The aircraft is equipped with leading-edge slats on wings over a 17 deg. sweep. Horizontal stabilizer has been raised 35 in. and increased 12 in. in span for maximum span control.

T2V-1 landing gear can clear four times more weight on takeoffs and landings than previous gear on Lockheed trainers. The complete system, located behind gear can be in-ground hydraulically raised in the down position to raise the nose for faster climb on steep climb.

• **Nasals**—Lockheed-Norwegian equipment in the T2V-1 includes radar and ADF installations, fuel puff sensors and VOR-locator, attitude gyro, a communications gear compass and landing device.

• **cockpit safety features** include an "inside windshield" made of two sheets of laminated aluminum anchored with steel coils. If the engine is jettisoned, the union pops up automatically to prevent windblast injuries.

• **Door**—The door of the T2V-1 is 4 ft. higher than the front seat to improve visibility. Two-one instrument panel have been used on the instrument panel so that the pilot, by flipping switches, can see any type to read several navigational dials.

• **Range, Dimensions**—The aircraft is equipped with 210 gal. tanks that are nonexplosive. Fuel tank is made for rapid refueling and changing, however.

• **Approximate dimensions** of the T2V-1: length, 38 ft.; height, 43 ft.; wing span (including tip tanks), 82 ft.; Gross takeoff weight is approximately 16,000 lb., and total fuel capacity 760 gal. Range is approximately 900 mi.

Funds Outlook: USAF Stable, Navy Up

Air Force's requests for funds to finance new aircraft and related procurement will remain stable at the present level, but Navy's requests will increase sharply, according to testimony before Senate Appropriations Committee.

Secretary of Air Force Harold G. Elliott said "I expect that the USAF programs to maintain a modern, up-to-date air force will remain stable at the \$6.1 billion figure reported for fiscal 1956." New money appropriated by fiscal 1955 totaled only \$2.7 billion, but there was an unobligated carry-over from previous appropriations of more than \$46 billion available. Elliott said that now that the leadoff steps for the long pull plan have achieved "the best demonstration there is of the job that can be done when you go in with the right kind of money."

Secretary of Navy Charles Thomas said "Beginning in fiscal 1957, greatly increased obligating authority will be assigned in order to ensure that we receive in the future the amount necessary to keep our Navy and Marine Corps aviation units modern." The \$750 million asked by the Navy for new aircraft and related procurement for fiscal 1956 compares with \$2.7 billion for fiscal 1955. It will provide for delivery of 1,600 aircraft, starting in calendar 1957. During calendar 1955 plane deliveries will average 200 a month, or an annual total of 2,400. The Navy considers this rate required to support its present force level.

on tour...Gilfillan GCA Quadradar

A compact "auditorium on wheels" is now touring military and civil air bases throughout the United States to demonstrate the Gilfillan GCA Quadradar. Inside this streamlined, air-conditioned truck and trailer unit is seating capacity for 12 visitors, as well as the lightweight 4-in-1 Quadradar, a communications system, power unit, motion picture projection equipment and the new Gilfillan radar trainer.



Airports Get Set for Traffic Jump

Major airports in the United States are spending more than \$100 million to expand and change the face of their facilities.

The design trend is toward a larger, smoother flow of passengers, baggage and cargo to and from aircraft.

But improvements now under construction are only a step toward solving the big problem of developing an airport system capable of handling growing air traffic. America's air terminals last year processed more than 30 million domestic airline passengers plus additional millions for international air carriers, business travelers, military planes and private craft.

By 1964, annual passenger traffic is expected to increase to 60 million. \$500-million Program—To handle this flow, Air Transport Association says the U.S. needs a national airport development program of at least \$500 million—probably \$750 million. This means the federal government would put up from \$100 million to \$150 million a year, to be equaled by local matching funds on a 50-50 basis.

Federal appropriations have fallen far short of this goal. Airport aid was suspended in 1955, and Congress approved only \$22 million for 1955. The Eisenhower Administration has cut funds for fiscal 1956 even more, requesting a lean \$13 million.

Local government sponsors of airport projects, however, have indicated to Civil Aeronautics Administration that they are prepared to put up more than \$100 million if it is matched by federal funds.

Local government sponsors of airport projects, however, have indicated to Civil Aeronautics Administration that they are prepared to put up more than \$100 million if it is matched by federal funds. They feel funds that have been available provided as more than enough for years to carry improvements. The improvements now under construction are only a step toward solving the big problem of developing an airport system capable of handling growing air traffic.

Needed projects include new terminals, development of backports, longer runways of adequate strength to take modern transports, thoroughways to speed ground movements, clear approaches to runways and larger ramp areas.

Terminal Trends

Major new airport terminal buildings were designed for another passenger traffic and more rapid flow of baggage to and from transports. They also were laid out for easy expansion to meet future needs.

The trend toward single, direct circulation generally follows design criteria proposed by CAA in 1953.

Outstanding Projects—Here are some of the outstanding terminals completed,

Airport Meetings

Two major meetings of airport operators and officials this month will set the pattern for meeting immediate airport needs and planning for future expansion. They are:

- American Association of Airport Executives 1955 convention Apr. 16-20 at Tucson, Ariz.
- Airport Operators Council's annual membership meeting Apr. 24-26 at Seattle.

Principal topics to be discussed by both groups in the Federal-Aid Airport Program, AASAE and AOC have pointed with the National Association of State Aviation Officials in a survey of airport needs, which is to be reported on at the April meetings.

The grants airport money is intended to show the amounts of local funds committed for airport construction and modernization and what will be needed in federal financial assistance.

continued, started or proposed during 1954 and early 1955.

• New York's Idlewild International. This \$60-million project is a new non-stop permanent terminal, branching from the main single structure in a 10-building layout.

The additional design, to be completed in a 655-acre oval, will be able to handle 140 aircraft at one time. A single building capable of accommodating the number of planes would stretch nearly two miles long and be virtually unapproachable.

Main section of Idlewild's "New World City" will be a 2,100-ft-long terminal building and two adjacent, active wings. Additional buildings will be located in seven other buildings.

The largest air terminal proposed so far, this project is expected to handle more than 9.5 million plane passengers by 1965. The main section will be started this fall and is scheduled to be completed by early 1957.

• San Francisco International. Newest of America's air terminals, the \$15-million project is part of a \$50-million airport development program. It can accommodate 5 million passengers a year now and will be expanded to a 10 million annual capacity by 1960. This is an extraordinary example of design for easy growth.

The air story main building uses a variation of the two-level system for vertical separation of passenger traffic. Arrivals are channeled through the



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technical bulletin

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SAN FRANCISCO INTERNATIONAL is typical of new design trend in airport terminals.

ground floor, and parking departing
from San Francisco are one level higher.

Two 420 ft long fingers, or con-
course, project from the ends of the
terminal to serve transport loading
platforms. A 150-ft finger may be
lengthened in the future. As two addi-
tional concourses will be added when
time is needed.

• **Chicago's O'Hare Field.** New under-
construction, O'Hare's new terminal
will consist of a curved two-level main
structure plus a 300 ft long, two-story
concourse. Two fingers will project out
from one corner. The first stage of a
satellite expansion plan will be able to
serve 3 million passengers a year and 16
airports at one time.

Cost of the initial construction,
\$1,880,000.

One of the main elements may be
divided up the main frame and a third
finger added. Ultimate expansion pro-
vides for a circular concourse with five
split-end fingers able to handle 90 air-
craft simultaneously.

• **London's, Louis Municipal.** This
new three-story terminal building, now
under construction, has a more radical
design than any other current project.

The 345,000-sq-ft structure will have
a roof made up of three tiers of steel
supporting 10-in.-thick concrete cylinders.
Two-story fingers will project from the
sidings and ends of the terminal to
place loading platforms.

Five future expansions, three cylinders
may be added to the roof and the fingers
lengthened or more built.

• **Cleveland's Hopkins Municipal.** Scheduled to be completed this year,
the new terminal is part of a 15-stage
construction program.

The 365,000-sq-ft building consists
of a two-level main area with a ticket

and baggage wing and a seven-story con-
trol tower topped by a cab. It is ex-
pected to serve 1.3 million annual
passengers a year by 1960.

• **Wichita Municipal.** One of the
nation's newest complete airports,
Wichita's \$13 million field has a V-
shaped runway pattern with a 521-
million terminal building set in the
apex of the runway.

Terminal size includes the main
structure, a secondary control tower
and baggage fingers for plane loading
that can be expanded in the future to
14 positions.

The new airport replaced Wichita's
former field, taken over by the Air
Force as a B-57 training base.

• **Los Angeles.** One terminal and im-
portant project, Los Angeles Airport's
proposed new terminal building, was
not when city voters refused to approve
a bond issue to cover the \$9-million
cost.

Plans called for a circular building
with an oval ferry connecting from
the main structure. Each finger would
have 10 loading platforms for aircraft.
This layout was designed to minimize
walking distances for plane passengers.

The terminal building would have
had a domed roof, partly at glass.

Heliports and the Future

One of the key elements to the
projected increase of yearly passenger
traffic is management of scheduled heli-
copter service on shortland, rotary-air
routes. Capital service also is needed
to shuttle airline passengers from the
center of large cities to airports con-
sidered away from heavily populated
areas.

To start intensity and shuttle flights,

man from the "flyingest" business talks about Airwork.



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cypher stations must have heliports. But few military air carriers have the resources to finance construction of heliports or to pay in full for the operation cost.

City governments and their agencies probably will be forced to construct these heliports and operate them at a loss for some years, as they did during early development of airports.

One of the first heliports in the United States will be built at Andrews New York. Final plans are being developed by industry even whether to construct a small, interim facility or one able to handle expected traffic, no less than the next five to 15 years.

This heliport probably will be built and operated by the Port of New York Authority.

■ **Size Limit**—One outstanding problem in planning terminals for military aircraft is size. Many designs submitted so far would put the heliports on top of office buildings. Yet they must have landing and takeoff areas plus parking to park while loading or unloading personnel and cargo.

A possible answer to coming down the needed area would be automatically folding rotor blades. But the complexity of rotor hubs and blades makes considerable doubt that this would be practical.

Taking this one factor into consideration, a study by the Port of New York Authority concluded that heliports should be 200 to 400 feet. Parking area would accommodate five parked helicopters, and the gate time would average 12 minutes.

Capacity of this heliport would be approximately 40 helicopters or landings a hour.

■ **Practical Approach**—Determination of a practical size and location for heliports will solve one of the largest business area blocking impingement of helicopter service.

A working group of expert opinion, brought together by the International Air Transport Assn. last November at Montreal, and any attempt to fix the characteristics of rotor bases must be preceded by a relative determination of the use and location of heliports.

"The helicopter must be the landing area, rather than vice versa."

Senate Unit Aims for More Subcontracting

Senate Small Business Committee is going to consider three proposals to increase subcontracting by Defense Department prime contractors at hearings this session.

In its annual report, submitted by chairman John Sparkman, the committee listed them as:

- More secondary language concerning subcontracting should be used in military contracts.
- Either Congress or Defense Department should stipulate an actual percentage of the total contract value which would be subcontracted.
- All government-owned equipment in prime contractors' plants which constitutes duplication of equipment on the subcontractor's plant should be withdrawn.

Other points made in the report were:

- Research and development is "a very real source of contracts for the small business."
- In many instances, it has been found that the small firm is more suited to research and development work than for large contractors.
- There is still a "large area of undiscovered" contracts in the government's defense contract list.
- Secretary Charles E. Wilson, and top officials will be requested to testify on the reasons for using it.

Sen. Edward Tamm, ranking Republican on the small business group, has interpreted the presentment directive in setting up a list of preferred firms to receive the majority of defense contracts with no competition allowed from firms not on the selected list (AW Dec. 23, p. 17).

• Negotiation, which accounts for 93%

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of the dollar value of defense contracts since 1950, does not preclude competition. "But small businesses cannot understand why the armed forces tend to float the award of Congress," the report added, "and they argue that they might have a chance to bid on contracts which are advertised, whereas when negotiation is used, they do not hear about the procurement and are thus precluded from submitting a bid or proposal."

Appropriations Group Cuts NACA Budget

House Appropriations Committee to direct National Advisory Committee for Aeronautics' budget request for Fiscal 1956 by \$6.5 million, despite warnings of scientific communities of research effort by NACA members (AW Mar. 28, p. 18).

NACA asked for \$76.5 million. The committee allowed \$67.7 million, which is \$11.3 million more than NACA's Fiscal 1955 budget of \$55.9 million.

Major portion of the cut was \$7.5 million in the \$87.5 million requested for administrative and operational expenses.

NACA had planned an increase of 2,000 in its personnel next year to provide for the operation of three new windtunnels and increase the level of research effort. The \$58 million voted by the committee provides for an increase of only 218 in total size of the new facilities coming into operation.

NACA's \$53 million construction request for 15 new projects, including \$4.8 million for a nuclear reactor for testing of aircraft materials and components, was cut \$1.5 million. "If all the NACA will place the projects upon its competitive bids and which construction costs actually the same program should be accomplished within the \$11.7 million provided," the committee claimed.

Construction projects in the NACA program include installation of an air removal system for the 16-ft transonic tunnel at Langley Aeronautical Laboratory which will extend its speed range to include Mach 1.2, and provide for testing of large-scale models to determine characteristics of aircraft that be come critical in the low supersonic range; a high-speed free-flight facility at Ames Aeronautical Laboratory which will provide for investigations into the tremendous heat generated by vehicle speeds from 7,000 to 14,000 mph, a steel pipe firing test chamber and instrument room, also at Ames, that will permit investigation of supersonic burning and stability at speeds from 2,000 to 5,000 mph, conversion of the 5 x 6 ft tunnel at Lewis Laboratory to permit transonic operation.

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AVIATION CALENDAR

- Apr. 14-15—Agencies Civilian Airmen, 20th session of Foreign Ground Instrumentation Committee, Patrick AFB, Fla.
- Apr. 14-16—International Air Vehicle Manufacturers Council convention, San Francisco.
- Apr. 18-20—Virginia Association of Airport Executives, 1955 annual convention and business meeting, 25 Commonwealth Blvd., Fairfax, Va.
- Apr. 18-21—Society of Automotive Engineers, Golden Anniversary Automotive Meeting, Aerospace Production Forum and Aeronautical Engineering Display, Hotel Statler and MeAdey Hotel, New York.
- Apr. 18-22—American Society of Mechanical Engineers, Diesel Engine world meeting, including two profiles sessions, Lord Baltimore Hotel, Baltimore.
- Apr. 20-22—Virginia Rocket Society spring meeting, Baltimore.
- Apr. 24-25—Airport Operators Council, eighth annual meeting, Seattle.
- Apr. 25-26—Search for Experimental Stress Analysis, spring meeting, Hotel Statler, Los Angeles.
- Apr. 27-30—American Helicopter Society, 11th annual forum, Hotel Marlborough Washington, D. C.
- Apr. 28-29—Michigan Aeronautical Conference, University of Michigan, Ann Arbor.
- Apr. 28—Institute of Navigation, autumn regional meeting, Tweedside Airport, Baltimore.
- Apr. 29-30—New England radio-electronics meeting, sponsored by Boston and Connecticut Valley sections of IEEE, Sheraton Plaza Hotel, Boston.
- Apr. 30—Air Force Aero., Illinois Wing's annual convention, Sheraton Hotel, Chicago.
- May 1-5—Society of Aeronautical Weight Engineers, national conference, Hilton Hotel, Ft. Worth.
- May 1-5—International Society of Aeronautics, first national Flight Test Instrumentation Symposium, Allen Hotel, Wichita.
- May 4-6—Fuels International Aviation Trade Show, 61th Regiment Armory, New York.
- May 5—Fuels International Aircraft Meet Exposition, WWII Region Memorial College, Ft. Worth.
- May 9-7—National Inter-Collegiate Flying Assn. annual convention and air meet, Maxwell Field, Ft. Worth.
- May 18—Association of Northeastern College Flying Clubs, annual inter-collegiate air meet, Tuscon, Ariz.
- May 9-11—National Conference on Aeronautical Electronics, Edgewater Hotel, Hartford.
- May 16—National Pie Protection Assn. annual service convention, Netherland Plaza Hotel, Cincinnati.
- May 16-22—National Materials Handling Foundation, sponsored by Glenn D. Pugh, International Amphitheater, Chicago.
- May 18-22—National Television Conference, Marjorie Hotel, Chicago.
- May 23-24—American Society for Quality Control, sixth annual convention, Hotel Statler and New Yorker, New York.
- May 29—Federation Aeronautique Internationale and ICAO, Royal Netherlands Aeronautical, 8th International Air Display, Yperburg Aerodrome, The Hague.



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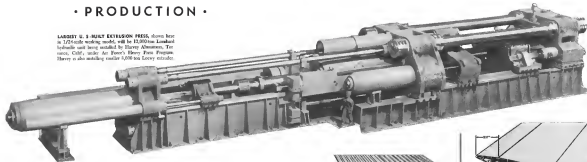
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LARGEST U. S. ROLL EXTRUSION PRESS, shown here in 17½-mile working model, will be 12,000-ton Lockheed hydraulic unit being installed by Harvey Aluminum, Torrance, Calif., under Air Force's Heavy Press Program. Harvey is also installing smaller 5,000-ton Levy extruder.



Big West Coast Extruders Near Production Status

By Irving Stone

TORRANCE, Calif.—New potential for extruding aluminum alloy configurations for aircraft structures will soon be available in the West Coast area.

Harvey Aluminum expects to have in operation by fall of this year two new extrusion presses—a 5,000-ton Levy and a 12,000-ton Lockheed—under USAF Heavy Press Program.

Structures for bombing the penis and their supplemental equipment, now

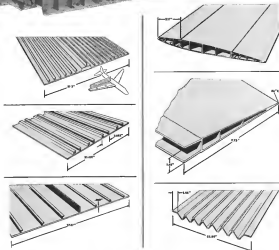
about 60% complete, have been created with Harvey tools. Supporting equipment includes heat-treating, straightening, roll straightening units, as well as finishing facilities, as noted last, etc.

► **Press Army**—The 12,000-ton press will be in the largest-size category of extrusion units to be built in this country.

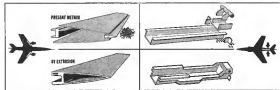
Aluminum Co. of America (Lynch, etc., Inc.) is operating a 14,000-ton Schwabach extrusion press brought

from Germany. Curtiss-Wright Corp.'s Martin Processing Division, Buffalo, N. Y., also will operate a 12,000-ton (Levy) extrusion press, but this will be basically for steel (see p. 34), and Kaiser Aluminum & Chemical Co. (Bellefonte, Pa.) will operate two 5,000-ton extrusion presses for aluminum alloy.

► **Types in Picture**—Harvey is now geared to accept orders for extrusion extruders for both present, is set up to proceed with required tooling. It is



PARTS PRODUCED ON BIG EXTRUDERS will offer lighter weight and greater strength. Typical applications: bulk-strutted skin with integral spar at center (above, left), aft lower fuselage wing skin blanket (middle), wing panel skin with integral stiffeners and attachment members (left, lower), engine compartment (in hot assemblies and analytical model wings (above, right), aft fuselage skin would be made of three separate parts, trailing edge skins (above, middle), and Zee stiffeners (above, lower).



ONE-PIECE ALUMINUM ALLOY EXTRUSIONS produced on the big 12,000-ton press will replace wings made by conventional "skin and spar" build-up. Left-hand drawing shows old and new wing leading edges; sketch at right compares old and new wingbox.

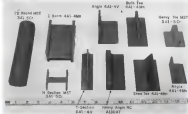
"Bogey at 6,000 miles!"

See, six thousand miles is beyond the range of today's radar equipment. But radar has been so highly developed since the end of World War II that who's to say how long it'll be until we're thinking in terms of thousands of miles . . . or more?

We're proud of the part we play in producing the world's most sensitive radar sets. Granted, it's a small part—many small parts—but our team of precision engineers, tool-makers and machinists makes certain that if we ship it . . . it's right! We work practically every major builder of radar equipment—supplying the mounts to which the scanners turn, twist and probe. We're confident, too, that in the future, we'll continue to furnish component parts that will enable us to spot bogeys way out there—yes, even 6,000 miles away! For a book on our company—its facilities, its people and accomplishments—just write to: The Steel Products Engineering Company, Springfield, Ohio, and ask for our new Flat Brochure.



**THE STEEL PRODUCTS
ENGINEERING COMPANY**



TITANIUM ALLOY EXTRUSION SHAPES produced by Heavy in experimental USAF program. Delivery on a mass-production basis is expected by year-end.

now quoting on future aircraft and missile component designs submitted by major aerospace manufacturers and prime subcontractors. These components include a wide variety of:

- Wide, integrally stiffened skin panels for wings and fuselages
- Large, hollow extruded shapes, such as landing wheels, fuel tanks for missiles
- Staggered and tapered configurations, such as wing spars
- Large one-piece parts, such as complete spars (and) plus caps, normally extruded in multiple parts, then fastened by our own rivets
- Large Stem-I-read now indicates that the largest demand for any one type of section will be the integrally stiffened skin panel. The 32,000 lbs press will supply stiffened goods up to 60 in. wide

and as long as 80 ft. (limited by size of vertical hot-test facility).

Minimum thickness generally required at this time ranges between .100 and .320 in., with alloys such as 7075 (7550, 2024 (7451, 6068 (685), and 7001 (H2M 100). Actual operating experience may vary these limits.

• Steps & Tapers—Staggered configurations, being produced at Heavy on 2,500- and 3,650-ton extrusion presses, will be available on the new presses with greater cross length and cross-sections and closer control of heats.

Tapered sections, generally considered to be in the developmental category today, should become more routine with the new presses, though refinements in alignment and material control

• Equipment—Staggering equipment is



CLOSE-TOLERANCE, NO DRAFT PRESS FORMING—includes top & bottom slotted extrusion cap, extrusion end carriage and, gas control assembly bracket, engine and/or nose support. (Right corner) aluminum frame housing.

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- READING AND COCKPIT FLOODLIGHTS
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Rolle and Arms
solve another
casting problem...

COMPLEX STRESSED AREAS MADE THIS A CASTING NIGHTMARE

PROBLEM: Arms Division of American Bosch Arms Corp., Garden City, New York, knew the difficulties involved in casting the illustrated aircraft armature part before it left the drawing board. The part was characterized by overlapping internal structure, with internal wall sections, complex wall junctions, and intricate internal webbing. All of which made proper feeding and chilling of stressed areas extremely difficult. Yes, because of the tough service the casting would have to withstand, Arms required that the sand casting pass 100% x-ray examination to highest aircraft standards.

SOLUTION: Arms brought the drawings to Rolle, where experienced metallurgists and skilled foundry engineers attacked the problem from every conceivable angle. A unique core set-up was first devised to simplify feeding and chilling of important areas. Then a casting program was created, specifying every detail of every step in the casting process, from pouring temperature limits to heat treatment requirements.

RESULTS: The complete story of this unusual part cannot yet be told, but sound castings are being produced at Rolle in good quantities, with each one meeting all of the rigid specifications.

YOUR CASTING PROBLEMS... whether they involve sand or permanent mold casting of aluminum or magnesium alloys... can always be solved quickly and economically if you bring them to Rolle. Write for free brochure on Rolle complete foundry service to Rolle Manufacturing Company, 3111 Clinton Avenue, Lansdale, Pennsylvania.

Fight weight with strength

with **ROLLE**
MANUFACTURING COMPANY

PERFORMANCE DATA
Sand cast stress steel
test part

Alloy: 4340 steel
Tensile: 110,000 psi
Yield: 70,000 psi
Elongation: 10%

as much as part of the picture as the pieces themselves. Thus, from a 52 ft. length heat for heat heat at Harvey today, the new facilities will almost double the length of part which can be handled.

Hydraulic stretch straightener for the output of the new presses will exert pull up to 1,500 tons to adequately stretch and out for the extensive operation.

A complete metal plant 31 is now completed, where aluminum will be cleaned and out for the extensive operation.

► **Titanium Waste-to-active program** with titanium alloys also is underway. Harvey now has a contract with the Air Force to investigate the extension of new titanium alloys (some of which are not yet commercially available) and the properties resulting from the extension process. Contract has been in effect about three months.

In addition to this, Harvey has been extending titanium alloys on an experimental basis for the aircraft industry. These have included 4045, 4045-102, 316M, 316L, 601, 601-102, 601-102-102, and 10-102A. Some of the alloys have been 75 and 80% base compositions tailored to the customer's specs.

Enriching of titanium alloys has revealed a number of difficulties, as have other methods for processing these materials. Nevertheless, Harvey's development work has been very promising, it is reported. On basis of results it appears that the extensive process will be one of the basic methods for producing structural alloys with the metal.

The company is expected to deliver titanium alloy castings on a semi-production basis before the end of the year. Full scale capabilities may follow shortly thereafter.

► **No-Draft Foundry**—Another important phase of Harvey's work is the production of close tolerance, no-draft forgings. Some of the no-draft units include items such as a stress reactor cap, engine air-cooling case supports, beam attach fittings and tubular attach fittings.

In process machining will be a big factor in competition with an 8,000-ton forge plant also slated to go into operation in the fall of this year and processed under the AF heavy press program.

Area of the process machining is to reduce forging holding costs and produce parts competitive in size with those which traditionally would have to be produced on a large size press.

New Titanium Plant

Melroe Shuman Titanium Corp. has completed a new melting plant at Niles, Ohio, which increases the firm's titanium capacity to 5 million lb. a year. The new plant uses four double-charging furnaces for melting titanium from scrap to ingot.

LOOK at these facilities facts...

...and you'll
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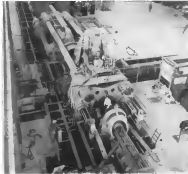
1. AT WYMAN-GORDON . . .

Industry Putting Giant Presses To Work

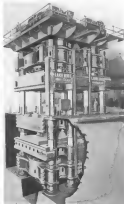
1. Coarse F-102 aluminum wing spars were first production parts turned out by 91,000-ton steel die forging press. It is operated by Wyman-Gordon Co. at WG-USAF plant, North Grafton, Mass. Parts for Republic F-105, North American F-106, Boeing KC-135 jet tanker and other planes will follow.

2. Sheet metal forming will be job of 16,000-ton hydraulic press installed at McDonnell's St. Louis plant. Built by Lake Erie Engineering Corp., it compresses iron 5,000 psi, soft-conditions sheets. Additional can be made at either or both ends to give an aggregate press capacity of 20,000 tons.

3. Propeller blades, airplane parts will be mowed from turned out as this 12,000-ton steel extrusion press being readied for operation in June at C-W's Metals Processing Division, Buffalo, N. Y. Believed to be the largest of its kind in the world, press was built by Leroy Construction Co. It will also process titanium and non-ferrous alloys.



3. AT CURTISS-WRIGHT . . .



2. AT McDONNELL AIRCRAFT . . .

with the help of **EPON[®] RESIN...**

**New paint
prevents damage
by hydraulic fluid,
exhaust deposits,
weathering on
Douglas planes**



Below right

Douglas DC-7, now finish-breaking heavy weather.

Applying Epon resin based "Epi-A-Lac" to exterior wing and fuselage of Douglas DC-7. Epi-A-Lac is manufactured by Shell Chemical Co., Torrance, California.

FIRST-REPAIR hydraulic fluid, widely adopted by the airlines, electric railway paint. Faced with this problem, materials experts of Douglas Aircraft Company began a search for a protective coating that would stand up to jet fuel, hydraulic fluid, as well as wind and rain, corrosion at air speeds of 300-400 mph, and corrosive exhaust deposits.

In several years of investigation, more than 300 formulations were tested. Finally "Epi-A-Lac" (formulated from Epon resins, applied in exhaust path areas, was 100% intact after more than 1000 hours in actual airline service.

Because of the unusual durability

of Epon resin-based coatings, they have been adopted by Douglas and leading airline operators for plane areas exposed to hot exhaust gases, gasoline, hydraulic fluid and cleaning solvents.

If you want a paint that lasts longer, one that has excellent adhesion, resistance to abrasion and impact, ability to withstand extremes of heat, humidity and corrosive atmosphere . . . ask for Epon resin coatings. Call on our sales office for the full Epon coatings story in the new brochure, "Plating to Paint a Pyrexal!"



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Toronto • Montreal • Vancouver

EPON resins are the epoxy polymers made exclusively by Shell Chemical Corporation.

AIRBORNE

Where they're made This is an aerial view of the Aero Division plant in Minneapolis. Over 15,000 square feet of its 22 acres of assembly plant are devoted to gyro assembly alone. Over 5,000 people work on aeronautical products. Hundreds of these work exclusively on gyros, making Honeywell a leading specialist in the gyro business.

VERTICAL



Capable Vertical Gyro, J67644

Ideal as a vertical reference. For use in radar calibration, for cross-bombing, navigation and flight control systems. Drives in 3 seconds - stops in 10 seconds.



Vertical Gyro, J67563

A proven vertical reference gyro with unusual reliability and economy. Primarily being used on aircraft, missiles and navigation systems.

No single gyro can meet all applications. One of these should match your needs.

GYROS

Why they're so dependable Honeywell gyros are assembled in an unattended, precision room guarded by a double air lock. To control air and dust, workers are required to wear special caps and gloves. With test and production facilities unparalleled in the business, Honeywell produces thousands of precision gyros a month.

FLOATED



MG-4 Gyro, GG14

Lightweight, extremely accurate floated gyro being used on the latest fire control systems. Most accurate and sensitive of the miniature gyros.



MG-5 Gyro, GG1

Most popular of the fully floated winging gyros. These are over 15,000 of both military and civilian gyros in use.



MG-6 Gyro, GG12

The world's most accurate induction gyro. Yet a very small package that gives the extreme sensitivity and accuracy demanded for tactical missile direction.



RATE



Rate Gyro, J67635

A general application rate gyro whose dependability and accuracy has been proven through inspection of position in a considerable defense security critical system.



Rate Gyro, GG13

Gives the utmost in performance for a wide-based, damped Rate Gyro. Extremely rugged and light in weight.



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A viscous damped, among the most accurate gyro giving the qualities of high precision, small size and ruggedness needed for missile and flight control applications.

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How to find out all about them Honeywell gyros are available to manufacturers who require precision performance. For details wear on your business card to Dept. AW 4-55, at the address given below. Or, if you prefer, pick up the telephone and call Joseph E. Holt at Minneapolis.

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Glengary 3-1600

PRODUCTION BRIEFING

► **Bundy & Polson, Inc.,** Detroit, is now rolling magnesium-diecast alloy HK31XA plate and plate, for jet engine and missile applications.

► **Bury Castals, Inc.,** is the new name for former Bury Corp., Watertown, Mass. Firm specializes in shock and vibration isolation.

► **Frederick Products, Inc.,** 1335 South 21st St., Phoenix, Ariz., is now firm specializing in manufacturing of tools, dies and mold components for the aircraft industry. President is Alexander Root, formerly with Boeing Airplane Co., Seattle.

► **Product Packaging Engineering, Calver City, Calif.,** is now name for Fox Hills Tool & Die, maker of heat-treating and packaging machinery, aircraft and industrial tools and dies.

► **Measuring absolute resistance of coarse coatings on metals, regardless of gloss, color, thickness or surface area, can be done with new technique developed by National Bureau of Standards, Washington, D. C.** Carbon dioxide gas under controlled pressure projects an obscuring powder from a vibrating storage chamber through a nozzle of high speed. Accurate measurement of the effects is possible.

► **Deutch Co., Los Angeles,** is now manufacturing and distributing complete line of AN electrical connectors formerly made by Motorola Division, General Electric Co., Providence, R. I. Deutch also will make an improved quick disconnect, potted connectors and hermetically sealed connectors.

► **Douglas Aircraft Co., Inc.,** 41 Serrano Avenue, Calif., plans to occupy a new \$426,300 structure for Controls Laboratory of Engineering and to display full scale models. An electronic reading computer will be used for flight dynamic and analysis of aircraft design and fire control systems.

► **Permetec Tape Corp.,** New Brunswick, N. J., has moved to Dallas, Tex. division warehouse and office is 9088 Denton Drive, Dallas 24.

► **Robey Rotor, Inc.,** Culver City, Calif., has expanded its facilities. Firm makes sub-sonic and supersonic rate and directional guns, vertical guns, gyroscopes and missiles and missiles in motion. Aircraft Instrument Co., Hawthorne, Calif., former exclusive sales agent for Robey, has become a part owner of the firm.

WE'RE LOOKING FOR ENGINEERS WITH ABILITY

Stratos—now developing new air-conditioning systems, starter-torque drives, controls and other pneumatic accessories for aircraft and industry—is interviewing well-qualified men as

RESEARCH ENGINEERS

For investigations and studies in pneumatic refrigeration and very high speed power machines.

PROJECT ENGINEERS

Several—Intermediate and Junior.

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Several and Juniors.

Write to E. T. Bartlett, outlining your qualifications for these interesting and challenging positions. Your correspondence will be kept in complete confidence, of course.

Excellent housing available in area. Convenient to New York City.

Wonderful recreational facilities. Fine beaches—Fishing, Boating, Golfing.



STRATOS

A Division of FMC/STC Engines & Airplane Corporation

ANY ENGINE, I, I, N. Y.

Manufacturers of air-conditioning equipment and pneumatic accessories for high speed aircraft.

LORD FACTS ON VIBRATION

ANYONE CAN MAKE VIBRATION CONTROLS

Practically every mechanism is subjected to either destructive wear or impaired performance because of vibration or shock... and practically anyone could make a unit to "solve" these problems to some degree. It is important, however, that the vibration control units contribute to improved operation and efficiency of the mechanisms—and at reasonable cost.

The use of makeshift or incorrectly applied units usually makes the conditions worse instead of better.

Lord has devoted over 30 years to the successful solution of thousands of vibration and shock problems. Lord research, engineering, and production facilities have produced over 17,000 types of highly effective control units for all kinds of applications.

Exceptional engineering and manufacturing skills plus the use of only the best materials provide users of Lord products with several outstanding advantages:

EFFECTIVE VIBRATION ISOLATION—Lord units reduce operating vibration, shock, and noise to the lowest practical level—over a long, service-free operating life.

LOWER MAINTENANCE COSTS—Effective isolation provided by Lord systems reduces destructive vibrations—lowering maintenance adjustment and parts replacement costs.

FLEXIBILITY IN USE—Lord extensive design and production facilities have developed a group of standard mountings of several types. These are adaptable to many standard vibration control applications and provide effective and economical solutions to a wide range of problems.

The extensive facilities at Lord are available on request for solution of your problems, whether they are simple or complex. Simply call or write the Home Office, Erie, Pa. or the Lord Field Engineer nearest you.

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SINCE 1924

WHAT'S NEW

Telling the Market

Data on vibration, and products to alleviate the phenomenon, are included in Bulletin 616 offered by MSE Measurement Co., Inc., New Haven, Conn.

Alloy Steel Pipe 041 is title of 200-page handbook aimed at engineering, purchasing and management personnel. More than 60 case histories of use of this material in modern equipment are given. Write or letterhead to Climax Molybdenum Co., 500 Fifth Ave., New York 36.

Both steel and aluminum-type contact electrical connectors, available in pin polarization and new basket polarization, are described in Catalog H4, available from American Plowshare Corp., Chicago 10. . . . Lists of pressure-sensing tubes for numerous out-of-the-line operations are given in 56-page manual being distributed by Minnesota Mining & Manufacturing Co., Dept. P-557, St. Paul, Minn.

Two grade of KC 55 and KC 70 titanium tube and pipe with advantages and applications, physical properties and handling characteristics, are described in bulletin being distributed by

Alloy Steel Tube Division of Carpenter Steel Co., Union, N. J. . . . Universal joints are comprehensively described and applications given in 12-page catalog available from Joint Division of Gear Grinding Machine Co., 3901 Christopher, Detroit 13.

Colonial "F" convertible broaching machine, capable of horizontal pin broaching and vertical pins and pull-down broaching and pins only, is covered in Bulletin FW-55, White Colonial Broach Co., Box 57, Harper Station, Detroit 13. . . . Full-view Rotameters for measurement and control of flow are detailed in Bulletin 115 being distributed by Brooks Rotameter Co., Lansdale, Pa.

Type 21-103C mass spectrometer, capable of determining composition of mixtures with an error in 90 or more components varying in weight and complexity, is described in Bulletin 1800C available from Consolidated Engineering Corp., 306 N. Santa Madre Villa, Pasadena 15, Calif. . . . New high-pressure welding techniques for economical production of glass-reinforced plastics in complicated shapes with metal inserts, if required, are covered in Bulletin CRP-1 by American Hard Rubber Co., 95 West St., New York 15.

Recommendations for subsiding priority in aluminum castings are given in Producing Lightweight Aluminum Castings. Write George Self Metals Co., 2108 E. Butler St., Flint 14, Mich. 37, Pa. . . . Subcontracting activities of Mack Equipment & Machine Co. are provided in brochure, 527 N. Indiana Ave., Atlanta 26, N. J.

Selection tables, instructions and installation data on new screw-down unit is given in Bulletin 715 B available from Heli-Cyl Corp., Danbury, Conn. Details on small 15+ dc continuous-duty motor for applications requiring high torque and good speed regulation are given in Form PM4-014, Write Delstar Co., 1515 Clay St., Santa Clara, Calif.

Tensile data on 17-7 PH (precipitation-hardening) was provided by vacuum structure and elastic qualities available to high-quality spring steels and exotic wire are given in bulletin available from Norton Standard Co., Niles, Mich. . . . Numerous types of machine handling and storage equipment, including stockpiles, streamers, pellets, trucks and lock storage drums are covered in booklet being distributed by Stachurs Corp., 1311 Main St., Pawtucket, R. I. . . . Complete standard line of Type FSR BP reference apparatus films is provided in catalog by Filmos Co., Inc., Flushing, N. Y.

900

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ACTUAL
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U-51680-1 FUEL TO OIL HEAT EXCHANGER

inlet Temperature, 7-20	428
Fuel	110
Flow, 1/2 in. - 24	35
Fuel	16.7
Pressure 2000, psi (distillate)	8.6
Oil, 50 lb/min at 100° F	23.5
Fuel, 100 lb/min at 100° F	23.5
Shell Port Pressure, psi - 24	240
Fuel	3000

DISPLACEMENT 36 cu. in.
WEIGHT 1.4 lb.



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Continuous specialized design and manufacture for nearly two decades

HARTWELL FLUSH LATCHES AND HINGES are specified for their proven freeze-resistance, vibration-proof characteristics.

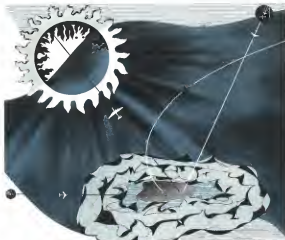
Flush latching device adaptable to special aircraft latch design requirements and productivity through 309 combinations of hole and trigger offsets.

HARTWELL Engineers are not only proficient in coping with the various problems of your particular application—but willing to help you and answer in time and cost to suit.

You're certain of just one standard of quality—the highest, because it's specified day in and day out.

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The father of our time is the Sun, whose day we daily witness last about 81.75 to 81.80 minutes. It is a distant star, and even so our eyes gaze at it as the sphere on its surface—radiating within the great circumference of creation. To the Westerner, time is not merely, until the clock—now the destination, passing, time passing on.

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AERONAUTICAL ENGINEERING



V-2 VEHICLES are portion of the mobile fleet required to transport, erect, service and launch the only ballistic missile.



NIKE MISSILE is served by acquisition and guidance radar, used for control and command centers and mobile launchers.

Support Units Are Key Part Of Aerial Weapon System

By David A. Anderson

Sub-free streams of support equipment go into squadron service with one of today's typical missile systems.

They range from simple loading and transport trailers to synthetic trainers as complex as the missile itself. More than 50 of their pieces of equipment are in the physical, in the missile.

Design, development and production responsibility for all these "extra" items falls on the shoulders of the prime systems contractor.

► **Building on Wheels:** "We started to build missiles, and wound up in the trailer business," said one aerospace executive.

He was looking out over an assembly floor as, which two parallel bars led toward the factory door. Down the line stood missiles, brightly painted, in various stages of completion. Down the other was an enormous assortment of wheeled vehicles, small trailers, large trailers, transport trailers, wheeled dollies, loaded wagons. Each of these items had a specific place in the missile system, each was a vital link in the final operation against an enemy.

To the contractor, the missile system was a complete reversal of the conventional aircraft business, where the air frame was the biggest end product. Here was a business where the airframe was almost subordinate to the rest of the

system, where wagons and trailers and transport cost more dollars than expendable missiles.

Fitz helps explain why an aircraft designer is no longer essential to the development of an air weapon, and how a company can fall into the role of a sub-contractor in an electronics firm, a university or an automobile manufacturer.

Ancillaries

There are a half-dozen types of equipment that support a missile operation in the field: servicing, handling, loading, checkout and test, launching and tracking.

► **Factory to Field:** Trace a typical rocket-powered missile from the time it is shipped from the factory until it goes on its first mission.

It is off-loaded from the train, placed in a mobile launcher, moved to the operational area, and transported to an assembly and inspection area. After assembly, it is checked out, its release gear and powerplant may be tested

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and 6 CHANNEL "150" SERIES OSCILLOGRAPHIC RECORDING SYSTEMS

In addition to



Other Models

Also 1 and 6 Channel Systems for recording analog computer outputs,



as after applications where 1 volt/cm sensitivity is made available. This system shows compass bar Model 150-0000 Dual Channel DC Amplifier and an eight channel transfer assembly. Dual Channel Amplifier, at complete with common power supply. (The 6 channel version is optional, except for less than 400000 and one less Dual Channel Amplifier.) Also the channel models.

Write for writing material on any Sanborn "150" Recording System

SANBORN COMPANY
CAMBRIDGE 35, MASS.

size floor track and in emergency vehicle. In one case, an aircraft carrier designed a single-unit recording vehicle to handle propeller bearings for an airplane powered by an auxiliary engine test. The track was about as big as a commercial for engine. This is some indication of the size and complexity of the problem a designer must tackle.

Rocket powerplants have a unique problem in the case of an aborted mission that never gets off the ground. The facts must be off-loaded. This requires special equipment for emptying fuel tanks and purging them, and other dumping or transferring the off-loaded fuel to another vehicle. This operation requires the same safety equipment as taking weight.

Pre-flight Check—Design and number of check-out and test vehicles depends on the system, according to our contractor. For his example, there is only one checkout vehicle, with a minimum of seven or eight vehicles that quickly determine whether or not the vehicle is ready to go.

The main check requires three special test points of test equipment for the preflight and seven for the rest of the engine.

These items combine all the necessary check and test facilities to give the maximum of a minute. They furnish a way of checking the complete operational cycle of the engine on simulated runs from a ready status up to the launch.

In several of the contemporary models, a completely new philosophy of testing had to be developed, with the consideration that the system was to be operated in the field by men without specialist ratings.

Thus, every checkout operation had to be built around an instrument or diagnostic operation. This was done with automatic sequence switches which cut the test under test into a circuit with a single "good" or "bad" indication. If the answer came up "good" the switch could be advanced to the next position. If "bad" then the switch could not be advanced until the faulty item was replaced with a complete new component.

In the design of the engine system, the components were developed as plug-in units. In the event of a malfunction, there is no need to turn or cut off the field level hardware, the faulty test is turned out and a new one designed in with a minimum of delay. This means the test points at vehicle equipped a succession of duplicate components.

In addition to test equipment that goes into the field with the vehicle but few in operation, there has to be a complete set of test gear developed to fit other unique requirements of the fac-

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This new Scott regulator weighs only 2.34 pounds. It is easily maneuvered with 4 D-cell batteries in standard panel space.

Lighter components for lighter aircraft

Military pilots are protected against the dangers of cabin pressure loss in Strategic Air Command B-52 Bombers equipped with the new MB-3 Oxygen Regulator. Automatic, fool-proof operation at deadly altitudes insures a completed mission. This pioneering new regulator is a recent achievement of Scott-Furwell developed in conjunction with the Air Force Aero Medical Laboratory. It is designed to meet the requirements of the Air Force Partial Pressure Suit but may also be used with the standard A-13A Oxygen Mask.

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tory assembly area and the test firing site.

General practice with rocket powerplants is to put them through a proof run at the factory under static and environmental test. When the field units get involved, they check only the power-plant functions without an actual firing.

The first rocket firing after leaving the factory is the real one, for the reason. This procedure is possible only where reliability is involved, this is the case for current rocket motors.

► **Launching**—Missile launchers come in a wide variety of complexity, from the fixed underwing racks of some anti-air missiles through the multi-missile storage magazine and racks for the Nike system.

In some cases, the missile support during transport and handling becomes an integral part of the launcher (as in Nike) in others the launcher is a completely separate item.

General-purpose missiles require a simple stand that can be leveled (Goropod) or mobile self-propelled unit adjustable in elevation angle and capable of traveling over the rugged terrain of the battlefield (Nike, Honest John).

Training Aids

Training techniques and equipment are a major project in the systems context.

One air-to-surface missile training field use is accompanied by 11 mobile trainers, including special flight simulators for the pilot in the driver's air craft, a missile simulator, weather-representation trainers and several pieces of maintenance training aids.

► **Simulated Missions**—The same project used, during its development phase, some modified jet aircraft flying simulated missions with the precision equipment associated in the use of the plane. These were chieftain tests, even these had trainers for pilot familiarization for live fire flights.

The importance of training aids for maintenance personnel has long been known in the aviation industry. The increased complexity of missile systems has made imperative an expansion of training aids to include actual components that can be fed simulated faults, much as ground simulators are fed into their simulators for pilot training.

► **Buildings, Too**—The list of missile equipment has not included the training members of buildings or shelters that have to be provided for operations in the test area and later in the field.

Command centers for field operations are usually in a trailer containing the launching control panels, presentation of tracking and guidance systems for the entire battery, and the necessary

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Conventional indicators

Recognizing the need for improved readability without increasing panel space requirements, The Lewis Engineering Company has developed these completely new Aircraft Temperature Indicators both in the Thermocouple Thermometer type and in the Resistance Thermometer type.

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Sanders Beats Out Top Avionics Firms

By Philip Klein

Nashua, N. H.—Three things made Sanders Associates, Inc., as a fast-rising avionics newcomer that bears close watching:

- **Fast growth**—but even for an industry where rapid expansion of new companies is almost commonplace.
- **Numerous significant new developments** in a variety of fields that would do credit to a firm several times its size.
- **Long-range development programs** for a highly classified equipment which, if it "lets" could prove as big as the radar center fire control program which launched Hughes Aircraft on its infinite rise. The company scored in its two major avionics firms (Winghouse and Bell Telephone Lab), which also had Phase I study contracts, to get the Phase II hardware contract.
- **Fast Rise**—It was less than four years ago that a hopeful group of 13 young engineers with \$75,000 capital started by mortgaging houses and life insurance, set up shop here in the top floor of a rail (and commuter) shut had been abandoned by a textile firm.

Today the company employs 310, a figure expected to rise to 500 by July. Its current year's gross sales will run nearly \$5 million, and by 1975 should go "well over \$12 million," with employment topping 1,000, a company official says.

The firm's president, Gordon C. Sanders, Jr., a public insider with 33 patents, is credited with the development of FM/CW radar in America.

• **Notable Achievements**—At the moment Sanders probably is best known for its two double air guns, measuring 1 m in diameter and 2 m long, and weighing only 1 lb. When first an inventor nearly three years ago, it was by far the world's smallest air gun, a distinctive it can still hold although with some competition. Sanders also made news as a participant in the Navy's Project "Inkster" autonomous bottom program. Its contribution was the selection of several cutting avionics capabilities to Inkster's instructions for comparative evaluation of the new technique. This type of activity is continuing, and the firm recently received an order for "Inkster-coat" installations.

New Developments

However, those again destined to be considerably in development sponsored during the past several years



NEW RADAR UNDERGOING TEST atop abandoned textile mill looks out on Nashua, once famous for textile mills, but now home for Sanders fast-rising avionics firm.

and new ready for disclosure, at those still in process. Some of these, which hold considerable promise of making Sanders Associates a well-known name in the avionics field, include:

- **Fluorescent low high altitude radar altimeter**, which reportedly will give the high accuracy of an FM altimeter at low altitudes and the accuracy of a pulse type radar altimeter at high altitudes, yet will weigh only half as much as the best FM or pulse-type altimeter now available. The new APN 95, a USAF

sponsored development, is expected to weigh only 25 lb., operate up to 30,000 ft altitude. Sanders beat out 17 other firms to get the contract.

- **Naval airborne radar antenna feed**, which permits the radar to get three times as many looks at the target (300/second) as conventional feeds. The feed mechanism requires no rotating parts and is extremely and dimensionally balanced, eliminating shock vibration problems.
- **Plastic radar antenna dish**, which



FLUSH-MOUNTED radar antenna, under 1 m thick for high-speed aircraft, employs flat slotted array. Power divider (a) uses same photo-etch technique.



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**Vital link between thought and action
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RADIO COMMUNICATION, oldest of the electronic sciences, has long played an important role in the thought-action process, yet today it is being called upon for capabilities and performance characteristics far beyond those afforded by the present state of the art.

Such demands stem from the basic importance of advanced communication systems in maintaining American military superiority.

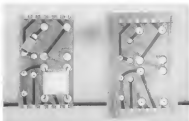
Recognizing this, The Ramo-Wooldridge Corporation is today engaged in research and development activities leading to the production of radio communication systems capable of providing the information capacity, versatility, range, and reliability necessary to insure maximum performance of our weapons systems.

And yet the challenge is not all military. It is inevitable that the application at Ramo-Wooldridge of these advanced modern theories and new techniques will lead to significant accomplishments in the field of commercial communications as well.

The Ramo-Wooldridge Corporation

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Engineers and physicists qualified to undertake advanced work in systems analysis and engineering, aircraft development, transmitter and receiver engineering, modulator development, and propagation studies are invited to investigate the opportunities existing in RF and microwave communications, data transmission, telemetry, and allied fields, involving those of Ramo-Wooldridge.



HERMETICALLY SEALED geared control boards and flush mounted high impedance remote and capacitor mounted at left are new Sander developments.

Sander says can be molded more accurately than conventional open elements or magnetics tubes, giving a bearing error of 4 angular mil or less. The plastic disk is stronger, weighs only half as much as aluminum and has up to 100 times the life of the magnet. This reduces drive motor power requirements.

• **Magnet two-stage solenoid valve**, measuring only 1/2 inch and weighing only 0.7 lb., yet capable of controlling 3 hp. of hydraulic flow down to electrical input of only 40 ma. (see photo, p. 66). Frequency response is reportedly a flat to within 3 db. at frequencies out to 100 cps., and the unit has built-in chipclipping protection to prevent jamming.

The new "bucking valve," as it is called, is approximately 1/5 the weight and size of comparable units, and will sell for 25-35% less, Sander says.

• **Photomatrix appearance measurement**, including irregularities, orientation, li-

lead junctions and flush antenna feed arrays. These new "Tri-Pulse" matrix-sensor components are considerably smaller, lighter, and cheaper than conventional components, and offer certain advantages over competitive photoetched matrices, components, according to Sander. These include lower reduction leakage, lower cost, less noise pickup from shock and vibration.

• **New magnetron**, capable of producing coherent pulses with an instantaneous power output to only 1% of the tube's output, approximately 1/4 the output previously required for coherent magnetrons, a Sander official says.

To date this has been achieved only with experimental low power units. However, Sander expects the same can be applied to very-high-power tubes. This might enable magnetrons to replace some of the ground test to high-power klystron tubes in aircraft.

• **Helicopter hovering device** (reporting



TRIMKOP version of an AFM-32 radar scanner is one of several equipments which Sander has redesigned to use modular type construction.

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BOOTSTRAP electronic valve for missile use can handle 5 hp., has frequency response of 100 cps., weighs only 5 lb.

on the Doppler radar principle) which weighs less than 75 lb. Sweden delivered the missile's model less than four months after receipt of the Navy contract. Weight of the production prototype, now under construction, will be only one-third the contract specification. This is partly due to the use of Tin Plate plating.

• Flat capacitors and resistors, especially designed for flush mounting on printed circuit boards on Project Tulewag, enable miniaturization (see photo, p. 61). Both types of components will be designed for 150°C operation. At present, Sweden is making the components by hand, but plans to tool up for production during the coming year.

• Hermetically sealed printed circuit boards which keep out moisture from the nuclear printed circuit and make it possible to dip solder both sides without solder sticking to unwanted portions of the circuitry.

The Sweden-developed process consists of bonding thin transparent sheets of Kell-F to both sides of an epoxy resin base board upon which circuits have been etched. At these points where solder is desired, it is only necessary to grind away the thin layer of Kell-F (see photo, p. 61).

Although developed originally for its own needs Sweden plans to produce the hermetically sealed units for other



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SOLID PLASTIC vote disks reportedly is cheap, light, more accurate than covers based upon aluminum disks.

is more firm to their individual count requirements.

Engineer Ownership

Sanders Associates is an engineering and operated business. All the voting stock is held by management, consisting of 14 associates, including Rex Sanders. All but one of the 14, the assistant treasurer and controller, is an engineer. Average age of Sanders management is about 35.

Nearly percent of the non-voting stock, which pays the same dividends as the voting variety, is held by company employees, according to E. C. Reel, assistant to the president. (But, a former Marine colonel, headed Sanders' discretionary division prior to joining Sanders.)

Release of the non-voting stock is held largely by local Nubian people. Contrary to early reports, Sanders has no large corporate backer.

But, that Sanders himself has an interesting background. While a junior engineering student at Rensselaer Polytechnic in 1918, he conceived the first idea (FMI) shaver. Sanders took the idea to what is now the Wright Air Development Center. The Air Force liked the idea, but was reluctant to give three-potential development funds to a young engineering student, no matter how significant. So the Air Force contracted with Bell Labs for the development.

Sanders interested Radio Corp. of America in the idea, got school and joined them. With Navy backing, Sanders and RCA developed the APN-1 radio altimeter, which saw wide use during the war.

Next came Sanders to Ford—Three of the men who worked with Sanders in the APN-1 development were Martin Radzinski, William Moore, and Donald May, all now associates in the parent company. Richmond is executive vice president and head of systems development. Moore is director of research,



SCRAMBLER—When time is scarce and speed vital . . . G-E motor-driven power units provide Air Force alert hangars with fast, reliable starting power. Shown is an F-4D Phantom, equipped with G-E J-47 jet engine.

HAMILTON AFB REPORTS . . .

G-E Ground Power Units operate 2 years with "No electrical repairs required"

G-E motor-driven units provide reliable ground power in 325th Fighter Squadron alert hangars.

Being a scramble, speed depends on how fast performance by men and machines. For fast, reliable aircraft starts absolutely essential in an F-400 Salvo jet assembly, the 325th Fighter Squadron at Hamilton AFB, California, uses G-E Motor-driven ground power units. For over two years, they've used four G-E units for starting duty in their alert hangar, and in that time, "No electrical repairs have been required."

This is just one example of reliable performance G-E Ground Power Equipment in providing many Air Force

alert hangars throughout the United States for both jet and reciprocating engines.

Power for instrument and device checking is also available with G-E 400-cycle Frequency Changer Packages. Motor-driven units in 265-, 300- and 3000-watt ratings, plus one and two generators for engine-driven or vehicle power units, fill out General Electric's complete line.

For further information, contact your nearest G-E Apparatus Sales Office, or write Section 814, DC Motor and Generator Dept., General Electric Co., Erie, Pa.

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Why G-E precision antennas can make your radar systems more effective

Advanced quality control and testing techniques enable General Electric to give you highly reliable precision antenna equipment that will help your radar systems give maximum potential range and accurate return-signal interpretation.

For example, the meeting of precise mechanical design requirements of radar reflectors is checked to within one hundredth of an inch by G.E.'s Custom-Checking Tower. Kinematic performance is completely tested on a modern pattern testing range.

For information on how G.E. can help you with radar antenna research, development, design, manufacturing, and field servicing, contact your nearest G.E. Apparatus Sales Office or write for Bulletin GEA 6279, Section 233-1, General Electric Company, Schenectady 5, N. Y.

Progress Is Our Most Important Product

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6-G 175-B, one of the first shipboard height-finding and search radar antennas, had assigned parabolic reflectors which presented difficult quality control problems. High accuracy of construction was maintained through the production inspection afforded by General Electric's Custom-Checking Tower.



COMPLETE ELECTRICAL TESTING of great F91-F radar search antennas being made on G.E.'s modern pattern test range. This range can test radiation patterns of all sizes in all essential radar frequency and is the final step in meeting some of radar antenna most specialized performance requirements.

PRECISION MECHANICAL INSPECTION to assure the meeting of exacting antenna design requirements is being made here with the aid of G.E.'s Custom-Checking Tower. Antenna structures up to thirty feet by thirty feet can be checked up within one hundredth of an inch through the use of this unique facility.



CHIEF PROJECT ENGINEER Harvey J. Brown (left), Ryan Industries, Inc., (right) discusses 6-G motor for Ryan Industries' internal bomber direction discriminator with G.E. Sales Engineer Hugh Tolson.

G.E. develops a versatile new aircraft motor to meet rigid specs of Ryan Industries, Inc.

"Recently we required an aircraft motor of extreme versatility to meet radio-interference, explosion proof, and other military specifications on an unconventional-shaped discriminator we are developing," says Chief Project Engineer Harvey J. Brown of Ryan Industries, Inc. "We took our problem to General Electric because of their proved ability to produce prototype and production models to meet our tight schedules."

"General Electric engineers developed a new motor which fully met our needs. And the close teamwork between our G.E. sales engineers and his factory specialists

enabled us to complete our development on time."

IN SERVING YOU, G.E. engineers can draw on unmatched experience gained in solving this and hundreds of similar aircraft motor problems. And they have at their disposal G.E.'s extensive aircraft motor development and testing facilities.

To take full advantage of this extensive engineering service, contact your local G.E. Apparatus Sales Office early in your planning. And for more information, write today to Section 764-31, General Electric Company, Schenectady 5, New York.

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American Airlines' Douglas DC-6's, like this one, are one of the country's largest airlines, heavy mileage and varying altitudes make tough demands on aircraft equipment. Improved reliability helps American give better service.

G.E. HELPS AMERICAN BOOST AIRCRAFT



Part of American Airlines' overhaul team at Tulsa, Oklahoma, shows DC-6 engine. G.E. work here will reduce airplane's maintenance time to improve service life of equipment.



Working in engine's compartment, American project engineer removes generator control panel in Convair. Maintenance is facilitated by easy removal of generator protective device which are grouped in G-E hand-service units.



G-E representative discusses generator installation with American project engineer. Average total generator life is about 12,000 hours. Some find 15,000 hours.



300-hp generator is prepared for installation on aircraft. New brush design can withstand effects of sea level and high altitude.

Convair generator control panel undergoes overhaul at Tulsa. G.E. work here will reduce airplane's maintenance time to improve service life of equipment.

G-E aircraft representative C. M. Gordon discusses generator installation with American Airlines project engineer. Average total generator life is about 12,000 hours. Some find 15,000 hours.

GENERATOR SYSTEM LIFE 100%

Power systems on Douglas DC-6's and Convair 240's give increased life between overhauls—maintenance time on other G-E components reduced

American Airlines engineers, with the help of General Electric, have increased aircraft generator system life on their Douglas DC-6's and Convair 240's 100%. The system was installed in 1948. For example, the expected generator life between overhauls of 700 hours on the DC-6's has been boosted to 1800 hours. This increase is the result of American's effort to extend its aircraft electrical component life between overhauls to keep pace with its rapid overhaul schedule.

New equipment life, performance were improved

Longer generator life has been brought about three ways: (1) Right size has been selected while keeping adequate margin of torsional vibration.

(2) Bearing failures have been diminished by supplying a special shielded type that will not migrate in its housing.

(3) An entirely new type brush has been developed that will perform properly, well in both high and low altitudes. The original components such as the reverse current relay and reverse current breaker have given American 100% hours of low-maintenance service. In addition, no overhauls are required between G-E and American have resulted in over-all system improvements such as over voltage protection of minimum cost.

How American Saves Dollars

E. H. Magner, A. A. 's Dir. of Aircraft Engineering states, "Reliability and low maintenance cost of G-E aircraft electrical equipment mean dollars for American Airlines." This reliability and low maintenance is a result of careful system engineering and sound equipment design which have

been brought about by a continuous co-operative effort among American, G-E, and the aircraft manufacturers.

How G-E Helps American

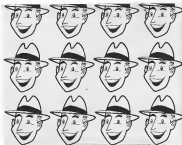
Early in 1947 American suggested service with Douglas DC-6's, and later with Convair 240's. Naturally, they placed high value on the reliability of their electrical equipment. G-E co-operated closely with them and the aircraft builders in working out the details of the system.

This co-operation did not end with the delivery of the equipment. Since that time, General Electric has been working continuously with American's engineering staff at Tulsa, Oklahoma, to improve the equipment's ability to withstand tougher environmental conditions and varying operational demands. The reason for this program was a good reason for American specifying G-E equipment as a new order of DC-6's and again last year when they ordered DC-7's.

Service Available to You

The story of General Electric's co-operative improvement program with American is being repeated with many of today's major G-E airlines. G-E engineers and service engineers are ready to work with you in both design and development of your aircraft equipment needs. For further information, see your nearest G-E Apparatus Sales representative. General Electric Co., Schenectady 5, New York.

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How Users Feel ABOUT OUR PRECISION SYNCHROS

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As the number one manufacturer of precision synchronos, we suggest a "with (or better) dependable grade" — that is, we can supply the most efficient synchronos to your system requirements, no matter what size or rate for the information on standard and special types . . . prices . . . and delivery. RELIABLE-PRECISION SYNCHROS, BENDIS AVIATION CORPORATION, CINCINNATI, O. 5.

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and B70 is a part of commercial development.

Following the APN-4, the group developed the APN-42 radar altimeter, the APN-6 night fighter radar, and the APN-17 low altitude bombing radar. In 1945, this group of four moved to Raytheon to work on the Luck missile. Sanders was manager of Raytheon's guided missile and radar division and the others held top posts in the division. At Raytheon, the division was joined by others, including Norman Wilm (general head of Sanders electronic department) and Maxton Giddler (head of special products department). In 1951, the group had decided to attempt what most engineers dream about—a company of their own. Strapping together \$75,000, Sanders Associates was formed and moved into the two top floors of the abandoned mill in Nashua. The city, laid by the loss of its long-established textile industry, welcomed the new firm.

It is doubtful if even the most optimistic Nashuaers could foresee that within four years, the tiny new enterprise would have expanded to that size, surpassed that of the departed textile firm.

► Rapid Growth—Within nine months, the company had developed an aviation rate gyro, a tiny blower fan cooling engine equipment and a miniature solenoid valve, forerunner of the present bootstrap model. Fast year's sales were \$500,000, pumping to \$1.5 million the second year and nearly \$1.5 million in the third.

On the strength of general and anticipated future orders, Sanders recently purchased the factory building in which it had been a tenant, giving it a total of 450,000 sq. ft., roughly as large as it presently occupies. Old factory residents are moved to the lower floors are now being cleared out preparatory to remodeling for Sanders' needs.

► Move to Systems Work—From its initial start in the components field, Sanders recently has moved into the systems and sub-systems business in a big way.

A year ago, the company had no prime system contracts as a whole. Today, approximately 70% of its current billing is in prime system contracts, according to Best. "At present, most of this is developed as prototype work."

The only "large scale" production at present is an miniature rate gyro (\$3 per month) and Trelcoley radars. Within a couple of years, however, Best expects that several current developments will be well along in production.

Approximately 45% of Sanders' prime system contracts are with the Air, 15% with the Air Force, and the



Silicone News

FOR DESIGN ENGINEERS

Silicone Paint on Space Heaters Gives Durable, High Style Finish

The trend to light, external finish finishes has created a demand for heat resistant and chemically inert finishes. To meet this demand, Dow Corning's Lining Mastic, a leading manufacturer of space heaters, offers a "plaster" finish achieved by applying an all-white coating over a light colored, modified silicone coating.



Formulated by Glidden Company, the plaster finish is more durable than any organic finish, and easily passes Dow Thermo-Tek test of 500 consecutive hours at a surface temperature of at least 450 F. Under the same test conditions light colored high temperature coatings based on organic resin, discolored, cracked and flaked. The modified silicone coating shows no deterioration.

To increase mechanical adhesion, DuPont also applies a modified silicone-ether coating to the heat exchangers of most of their heaters. Able to withstand temperatures in the range of 650 to 950 F, this silicone ether eliminates the swelling of organic coated heat exchangers when they are first fired in the user's home.

Because it does not crack or peel in service, this modified silicone coating makes it easy to apply to the stove body, flue and such details of the new Dow Thermo heater. The underside cover is coated with a straight silicone based finish that withstands temperatures up to 1000 F with no deterioration or visible deterioration.

Dow-Thermo space and tank heaters used in conjunction with the same equipment they use to supply organic based paints. Green Vitro and temperatures up to the same, ranging from 4 to 33 months in maximum temperatures of 450 F.

Silicones Reduce Maintenance; Aid Designers of New Machines

In building a machine to meet high speed production requirements, the Western Dyking Machinery Co. of Philadelphia makes good use of these Dow Corning silicone products. Designed to be the fastest and most efficient linotype tan silk dryer and cutting over, over developed the fully automatic "Model G2" has an evaporation capacity of 18,000 pounds of water per hour. Speeds range up to 180 pounds per minute per station.

Much of the increased capacity of this new dryer is due to operation at temperatures up to 435 F. But in developing the unit, Western designers found that such high operating temperatures presented problems not previously considered. The wooden fixtures supporting poles or rollers used in even of this type oil-coated and charred after a few weeks' service. Similarly, at 435 F, rubber gaskets have very low life and the possibility of fugitive heating fixtures in an otherwise expertly designed machine could not be tolerated.

Modified silicones the roller problem by supplying heat resistant, lightweight poles made of a silicone resin-wood material. To prevent any possible moisture absorption and to provide a better gripping surface, the poles are coated with Silicone the Dow Corning silicone rubber.

The rollers last indefinitely but the gripping surface could be renewed after 8 to 12 months' service. A modified form of the same material, a silicone compound that is easily applied and cured without removing the poles from the dryer.

The lubrication problem was easily solved with Dow Corning oil grease. Poured into the right range-type ball bearings in the conveyor system, the heat-stable silicone lubricant keeps bearings rolling at high speeds operating temperatures for years without relubrication.

The addition of Dow Corning 41 was based on previous experience with this silicone grease in the bearings of Nason's H14 oil dryer. Bearings lubricated with organic greases and exposed to 450 F in 41 Grease lasted less than 6 months; 41 Grease has yet to cause a failure.



Silicone Insulates Inductor Coil in High Temperature Electronic Unit

Wadsworth fabricated from Molex's, the Dow Corning silicone rubber, an major component in the new high-Q inductor inductor developed by Vector Manufacturing Co. of Houston. Used to insulate the unit's doughnut coil from the core, silicone also provides a heat stable rubber coating against physical shock. Tests indicate the silicone rubbers retain their original excellent dielectric and physical properties after prolonged exposure to operating temperatures of 400 F.

Vector also makes use of the temp Silastic left after the rubbers are cleaned from the coil. They use the ground-up scrap to fill voids within the inductor case. Finally packed, the masticured silicone further reinforces the seal, holds it securely in position, eliminates the need for supporting frames or bracing. Because Molex has a high order of thermal conductivity, the rubbers and pasting also help to dissipate heat generated in the coil.

Recent letters of Molex Fabricators, some more than 30 rubber compounds ready to make Silastic suits to your specifications.

Design Edition 8

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Midland, Michigan

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Canada: Dow Corning Silcones Ltd., Toronto. England: Midland Silcones Ltd., London. France: St. Gobain, Paris.



Richard Connelley, aerodynamics advisor, (left), (top); Aerodynamics Division head (center) and Irving Lipscomb, aerodynamics engineer and boundary layer control specialist, discuss effects of blowing boundary layer control on lift increments and pressure distribution.

New in a stage of major expansion, the Aerodynamics Division is one of the fastest-growing organizations at Lockheed, with unusual opportunities for advancement and promotion. Assignments cover virtually the entire spectrum of aerodynamics endeavor.

The expansion program includes such projects as nuclear applications to aircraft, extraordinarily high-speed fighters, new concepts in vertical rising aircraft, advanced versions of trainers and bombers, turbo-prop and jet transports, and a number of significant activities. Typical aerodynamics problems are:

1. Estimate improvement in maximum lift of wing/body wings with Boundary Layer Control for use in future commercial transports.
2. Estimate maximum speed and altitude capabilities of advanced supersonic military designs.
3. Determine ability of vertical rising aircraft to make transition from horizontal to vertical flight.
4. Estimate direct operating costs of new turbo-prop commercial transport under wide range of operating conditions.
5. Determine design tail loads on turbo-prop engine/propeller for all types of engine failure.
6. Determine ability of new trainer to make canopy landings and canopy take-off.
7. Establish design criteria for auxiliary damping servoactuators on future fighters.
8. Optimize approach and landing technique for use on night, short fields by rescue aircraft.

Career-minded Aerodynamics Engineers and Aerodynamicists are invited to participate in this expansion program. Address inquiries to E. W. Du Laney, Dept. A-3-6.

Hovering to high-speed flight:

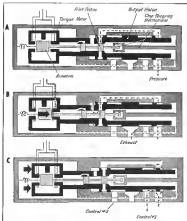
Lockheed expansion program offers wide range of aerodynamics assignments

LOCKHEED

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NOVEL BOOTSTRAP VALVE is a control, with no output from either control port, when balanced against cost as torque motor (A). When signal predominates on right side of motor (B), center moves right, opening center port which vents line pressure to second stage output piston. This moves piston to the right (C) and pressure strokes and center port is closed, simultaneously venting line pressure to control port No. 1. When signal is applied to left side of torque motor, line pressure is vented to control No. 2.

balance with Army Ordnance.

► **Inventory Management**—Considering Sweden relatively small engineering unit, manufacturing around 80, the firm has undertaken an ambitious number of projects. One partial explanation for its ability to handle so many design management tasks as active part is industrial agreements. The 14 in Sweden collectively hold nearly 450 patents.

In those days of high engineering turnover, Sweden has lost only two engineers during the past year, according to Best.

Bootstrap Valve

By means of an ingenious master/slave self-calling bootstrap passage, Sweden has been able to extend the frequency response of high power two-stage hydraulic valves out to 100 cps, simultaneously cutting size, weight and cost.

The new valve, particularly suited

to the control of high-speed aircraft and missiles, is a Sweden-financed development.

Early selected valves, developed during World War II, were single-stage devices in which electrical signals were applied to a solenoid whose armature moved the valve stem, producing a hydraulic flow proportional to the input signal. Because hydraulic flow forces reacted against the solenoid armature, the power need for higher hydraulic power required the use of larger torque motors with increased armature travel. This in turn reduced the valve's frequency response.

To get around this limitation, valve designers came up with a two-stage valve in which the torque motor armature was required only to actuate a small pilot piston, which ported hydraulic pressure to actuate a second-stage piston. This controlled the output to the hydraulic actuator.

As a result, it was possible to build



UTRON DIRECTIONAL GYRO



This Directional Gyro incorporates advances in the art of gyroscopes which achieve an unusual degree of accuracy, and at the same time assure ruggedness, making it ideal for airplane and missile applications where low drift is required, even under maximum vibration conditions.

SPECIFICATIONS

Size	Electric 5 to 10 in. length 15 in. height
Weight	11 lb.
Drift rate no loading	(including no. 10)
	0.175 sec. constant
Size	1000 lb. constant
Periodic error	0.0001"
Resolution	0.0001"
Accuracy	0.1%
Indication Rate	0.0001" (12 cps)
Vibration	100 G (500 Hz) constant
	selected in 2500 cps
Temperature Range	-14°C to +11°C

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marion meters

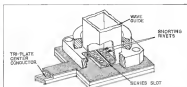
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TRI-PLATE center is shown in cross-section to illustrate waveguide

valves capable of delivering several horsepower, using smaller torque motors with reduced antenna travel (approximately 2.5 in. vs. 10 in. and 15 in.) and hence to obtain improved frequency response.

• **Build-in Feedback**—Recognizing that even higher frequency response could be achieved and smaller torque motors used if antenna travel could be further reduced, Sanders engineers sought a way to make the solenoid motor essentially a pure "force" device instead of a "force and motion" actuator. They have now achieved this by attaching the solenoid motor to the second stage valve, instead of anchoring it to the valve housing as in the past (see sketch, p. 79).

The trade is that motion of the solenoid relative to its terminal is shifted to approximately ± 0.002 in., only 1/4 that previously required. Even this may displacement costs only one-tenth, while the second stage valve responds, counteracting the torque motor and its actuator. The advantages of this "bootstrap" design include:

- Higher frequency response, which Sanders expects ultimately may reach 125 cps in production models.
- Reduced quantity between input and output flow. Maximum derivative is 14% of full stroke in prototype models tested, a figure which Sanders hopes to cut to 5% in production.

• **Mechanical Stress**—In addition to the "bootstrap" principle, the new Sanders valve boasts several other outstanding features. These include:

- **Anti-friction pilot valve** which relies on ball bearings to eliminate rubbing friction between the pilot piston and second stage valve stem assembly caused by side loading on the piston. This eliminates need for "lubric" (high-frequency electrolytic control vibration), except where extreme positioning accuracy is required, Sanders says.

- **Chip cleaning mechanism**, provided by small pins attached to the pilot piston (see sketch, p. 79).

If metal chips should get past by-

draulic return filter, automatically closing the pilot piston to head in a displaced position, the full hydraulic pressure to operate the second stage valve piston and the gun with a force of 110 lb., shearing off the chips and forcing the pilot piston, Sanders says.

• **Building block design**, in which valve body is built up from a series of stainless steel blocks which are then brazed together with ball surface bearing of the body (see photo, p. 60).

This construction makes it possible to machine internal orifices and joints, instead of employing external drilling and plugging of passages required in conventional one-piece body construction. It also makes it possible to provide rectangular orifices and ports for better linearity. (The torque motor is completely enclosed in the valve body, assuring an external linkage.)

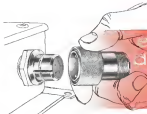
Prototype models of the Sanders SA-14 bootstrap valve will handle a 3 gpm at 1,000 psi system pressure (with 1,000 psi drop across the valve), or roughly 5 hp in a reverse operating mode. In production models of the same dimensions, Sanders hopes to up this capacity to 4 gpm. The firm also expects that the basic design can be scaled up to provide a 15 gpm valve in a 12x14x14-in. package, and a 200 gpm unit in a 24x24x14-in. package.

Sperry Gyro and several other firms already have purchased the new SA-14 for evaluation. In simple quantities, it sells for \$580, but a price of \$235 is being quoted in quantities of 1,000 units or more.

Tri-Plate Line

Recently an aircraft manufacturer faced a tough problem. How to fit the 5-in.-diameter RF head of a radar altimeter into the very thin wing of a new fighter.

Sanders came up with the solution. By redesigning, to substitute its new Tri-Plate (the conventional) connector. The 5-in. RF head depth from 5 to 3 in., enabling it to fit into



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To connect, you pull the coupling rag back... engage the plug with the receptacle... release. The coupling rag springs forward to lock the connection... no safety wiring needed. To disconnect, simply pull on the locked coupling.

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WHAT IT IS AND HOW IT WORKS



The Safety b/b Spline is the only spline in the world that is self-aligning. The average coefficient of friction of the Safety b/b Spline is .001, while the coefficient of friction of the ordinary spline is .010.



By applying this principle, the Safety b/b Spline will self-align to the shaft of the spline, thus eliminating the need for any lubrication.



The ball bearing provides a smooth contact point for the spline, thus eliminating the need for any lubrication.



The Safety b/b Spline offers great advantages over the conventional "wet-spline" and its landing gear.

The coefficient of friction of the Safety b/b Spline is approximately 10 times better than that of the conventional spline. It can be fitted with integral gears, clutch dogs, bearing and speed shafts or other accessories for use with electric, hydraulic or pneumatic drives—eliminating the need for troublesome drive shafts for the aircraft engineer. It is possible now to achieve "THE IMPOSSIBLE"!

By reducing weight and space requirements, the Safety b/b Spline permits installation of a drive system in a much smaller space. It is possible now to achieve "THE IMPOSSIBLE"!

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Making Tri-Plate

To form Tri-Plate, Sanders photo-etches away portions from one side of a suspended cylindrical laminate, leaving a copper strip conductor on one side, the opposite copper plate (ground plane) on the other. At this stage, it resembles PTL's Microstrip in appearance.

The next step is to place two identical laminate strips together so that the two copper strip conductors effectively become a single conductor sandwiched between the dielectric and two outside copper ground planes.

The two pieces are joined together with wires, which also function as shorting pins to maintain the two outer surfaces of the same potential.

the wing. Extra positive dielectric reduction would have been possible except for limits imposed by the magnetron and associated components, according to Norman Wild, head of Sanders' microwave group.

Like previously announced photo-etched microwave planing and components made by Pederal Telecommunications Lab (Microstrip) and Auralon Instruments Lab (Stripline), Sanders Tri-Plate offers considerable saving in size, weight and cost over conventional microwave planing in many applications.

However, Sanders naturally believes that its Tri-Plate offers certain advantages over the PTL and AIL designs.

►Variety of Components—The Tri-Plate fabrication technique can be applied to a variety of microwave components, including waveguide, hybrid junctions and directional couplers, variable and fixed attenuators, single and double-diplexers, and even to the new ferrite devices and antennas (see photos, pp. 81, 84).

One of the most significant applications for Tri-Plate is in the construction of compact antennas for both mounting on high-speed aircraft. Sanders has constructed one X-band Tri-Plate dual slot array antenna which requires only 1-in. thick photo, p. 67).

Using photo-etch techniques, it is relatively easy and inexpensive to fabricate a slot array with dividers which provide equal in-phase power to all slots.

►Tri-Plate Advantages—Although Tri-Plate costs slightly more to fabricate than PTL's Microstrip, Sanders claims advantages which it believes more than outweigh this factor.

►No radiation leakage. The enclosed nature of Tri-Plate eliminates the problem of radiation leakage encountered

with PTL's Microstrip. Wild says (PTL says it can provide a shield for its Microstrip which reduces radiation.) This makes it possible to use several Tri-Plate laminates close to one another, permitting more compact equipment design. Sanders tests at 4,500 mc show that cross coupling between two parallel strips of Tri-Plate is only .15 db, where the two are separated by 1/4 in., 70 db, where the separation is 1 in.

►Conventional measurement techniques. Unlike Microstrip, where special techniques are usually employed to make VSWR and phase measurements because of strip induction leakage, Tri-Plate characteristics can be obtained using conventional slotted line techniques. Wild says that Tri-Plate is more accurate than Microstrip, according to figures provided by the two companies.

At 5,000 mc, Microstrip attenuates at 0.15 db/in., compared to 0.05 db/in. for Tri-Plate. At 9,000 mc, the figures are 0.60 vs. 0.35 db/in. However, because of the extremely compact construction made possible by photo-etched planing, total system loss is relatively low for both types in many applications.

AIL's Stephen, consisting of a suspended conductor operating in air between two metal ground planes, has lower losses than either Microstrip or Tri-Plate. However, it is more costly to fabricate. Added disadvantages, according to Wild, is that AIL's loss is less rapid than Tri-Plate, hence more subject to variation caused by atmospheric moisture in both aircraft and in mobile applications.

Wild points out that during the center conductor on both dielectric plates in the Tri-Plate line (instead of in one solid rod), makes it relatively unresponsive to clamping pressure of the securing nuts. A separation of as much as 1 in. is possible without any observable change in VSWR and with less than 15 degree phase shift, Wild reports.

Like Microstrip, Tri-Plate has comparatively broad band characteristics. For example, a new variable attenuator



TRI-PLATE hybrid ring (a) is much smaller than conventional coupler.



TRI-PLATE hybrid ring (a) is much smaller than conventional coupler.

Canada, gave the B-570 100 knots. Including the wings, the ship is ready to carry a 100-ton payload. The ship is 100 ft long, 100 ft wide, and 100 ft high. It is a 100-ton ship, 100 ft long, 100 ft wide, and 100 ft high.

Thousands of experts, military and civilian, are working on the design of the ship. The ship is 100 ft long, 100 ft wide, and 100 ft high. It is a 100-ton ship, 100 ft long, 100 ft wide, and 100 ft high.

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Model L-270
Truck Type

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Model S-370



TRI-PLATE variable attenuator is broad-band, lightweight, low-cost pad

also employing Tri-Plate construction, which Sanders recently put on the market, can be operated as a calibrated pad at 1, 4, and 5 kmc. With an error of no more than 2 db (photo above).

It can be operated as an uncalibrated pad over the frequency range of 1 to 5 kmc. The unit is extremely light, compact, and low priced.

Wild reports that Sanders has completely explored Tri-Plate techniques at frequencies up to 6 kmc., and similar work at 30 kmc. should extend this range. In addition to applying Tri-Plate to its own microwave equipment developments, Sanders is anxious to take on outside work in this field.

Sanders' Tri-Plate development program, originally sponsored by Navy Bureau of Aeronautics (Industrial Planning Division) and National Bureau of Standards, is being sponsored by USAF's Cambridge Research Center.

New Silicon Diode Operates Up to 150C

Several new high-temperature silicon and germanium diodes and power rectifiers have been announced recently by two manufacturers. The new semiconductor include:

• **Silicon junction diodes**, suitable for operation up to 175C, with extremely high forward conductance and reverse resistance, are available in several types. One, the 1N138B, is rated 40 ma. at +1 volt. Others, with reverse ratings up to 100v are available also from Tantalum Electronic Corp. Company also is producing a line of silicon power rectifiers capable of delivering rated power at 150C. Company's address is Melrose 75, Mass.

• **Germanium diodes** in three new types, 1N205, 1N206 and 1N207, can be operated at temperatures ranging from -60C to 100C, according to manufacturer. The 1N207 is rated at



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At FARMINGDALE, LONG ISLAND, *Edwards Products Corporation*, achieve outstanding results on a complicated profile milling job using OK Tool high speed steel inserted blade milling cutters. A gang set-up of standard interlocking alternate angle, half-size and special chamber mills take out 44 cubic inches of metal in the fast time—four finish milling—of better than one cubic inch per minute.

Three plates, 36 x 8 x 1 1/2, chrome-molybdenum steel, are solidly bolted together using joint pins to

split toolbars. The job is completed in four operations as shown in the photographs. Number three Kennedy & Tremore milling machines are used and the total time for all operations is 120 minutes, an average of 49 minutes per plate. Tolerances are held to plus or minus .0006 inches.

This is another instance where high efficiency and economy are joined by correct job analysis and good judgment in the use of modern milling cutters on modern milling machines.



FLAT OPERATION—Steel inserts and rollers (24 x 1/2 x 1/2) are used to support the work piece (1/2 x 1/2 x 1/2) and the cutting tool (1/2 x 1/2 x 1/2).



ROUND OPERATION—A 1/2 x 1/2 x 1/2 inch roller (24 x 1/2 x 1/2) is used to support the work piece (1/2 x 1/2 x 1/2) and the cutting tool (1/2 x 1/2 x 1/2).



THIRD OPERATION—The work piece (1/2 x 1/2 x 1/2) is supported by two 1/2 x 1/2 x 1/2 inch rollers (24 x 1/2 x 1/2) and the cutting tool (1/2 x 1/2 x 1/2).

Write for OK Tool Catalogs



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for modern milling machines

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4 mva (max.) at +1 volt, 0.04 mva at -10v, with 20v d.c. maximum reverse voltage, at 85°C. Useful current 0.25 mva in diameter x 0.47 mva long. Bulletin ER 191A gives application data. International Rectifier Corp., 1521 E. Grand Ave., El Segundo, Calif.

Traveling-Wave Tube Tips Scales at 4 lb.

A new small lightweight 5 band traveling wave tube, which weighs only four pounds including solenoid, is one of several recently announced microwave devices.

The new TW tube, Model SL34-10M, reportedly has a 15 db gain, 16 mw output over the 2.4 kmc. band. Both dispersive and non-dispersive tubes are available in packages measuring 14 in. dia. x 13 in. long, including solenoid. Manufacturer is Stanford Laboratories Co., 1618 Broadway, Redwood City, Calif.

Other new microwave components:

- Minimum IF valve amplifiers, incorporating low-noise hot cathode, measuring only 5 1/2 in. x 5 in. x 2 in. and weigh 1 1/2 lb. Specifications for typical IF amplifier: 10 to 100 mc. center frequency, 2 to 12 mc. bandwidth, up to 120 db gain, 100 db or greater automatic and/or manual gain control, better than 2 db noise figure. Amplifier reportedly will operate between -55°C and 100°C, and under 30G shock and 10G vibration.

Manufacturer: KS Electronics Corp., 455 Postway Ave., Palo Alto, Calif.

- Minimum bandwidth variable input, pinpoint switching, of low currents by acoustic control. Non SP4T units are available in models for frequencies up through X-band, have 10 million second switching time, weigh 12 oz., measure

3 x 3 x 3 1/2 in. Ambient operating range is -55°C to 125°C. Actuator pins actuate at 15 to 30 vdc.

Manufacturer: Tuntex Products, Inc., 12139 Netherland Ave., Los Angeles 25, Calif.

- Low attention delay line, Model EL 06003/1120 has a d.c. capacitance of 0.4 pf. for a 50 microsecond delay and a 0.15 pf. rise time. Unit is a 120 section lumped constant delay line which can be supplied with tips every 0.3 in. Delay tolerance reportedly is 5%, characteristic impedance is 500 ohms, tip capacity is 400 pF, and spurious reflection less than 1%. Size is 13 1/2 x 3 x 1 in. Unit is designed for

operation at temperatures of -55°C and 125°C, but special units with drift of less than 10 ppm/deg. C can be supplied for operation between -65°C and 110°C. Manufacturer: Epcos Inc., 585 Commonwealth Ave., Boston 15, Mass.

Radio Station Signal Gives Position Fix

A new radio intercom system has been established near Albuquerque, N.M., by North Central Airlines to facilitate straight-in approaches to the tower's report during instrument weather.


The radio fix, called Shilohbird Inter-



BOOTS NEWEST PLATE-LOK®

STRONGEST . . . LIGHTEST

A new, light weight series of Boots **PLATE-LOK** . . . structure, self locking anchor units (fixed or floating) designed to meet MIL-N-25207 specifications. **PLATE-LOK** fasteners are a process development by Boots, pioneers in structure plate nuts since 1942.

PLATE-LOK'S  transverse locking design provides constant centering of screw or bolt in groove steel construction ensures highest tensile strength and lightest weight plus positive non-slip.

The new **PLATE-LOK** is another first by Boots. Its development traces back to Boots **TRI-LOCK** hexagon nuts, known for anchoring systems since 1945. Consult Boots on all self-locking nut requirements.

*Patent Pending

BOOTS
AIRCRAFT NUT CORPORATION



125 NEWTOWN TURNPIKE • NORWALK, CONNECTICUT



STANDARD LABS' traveling wave tube.



KS ELECTRONICS' tiny IF amplifiers

AVIATION WEEK, April 17, 1963

MORE ACTION IN SMALLER SNAP-ACTION SWITCHES

To Hetherington engineers, snap-action is a switch action a whole lot more than a little snap action accompanied by a little device action. That is, every Hetherington snap-action switch whether for push-button, toggle, or rotary operation, has the patented built-in mechanism shown here provides four definite advantages:

... an essentially positive snap-action that makes it impossible to "lose" the switch ON or OFF contact.

... lightning fast contact make or break for instant timing, delay-action switches are smaller, more compact and less expensive than the conventional switch.

... the "snap" and the contact make or break are simultaneous. (Descriptive "snap" or "snap" but can't see with the Hetherington snap-action mechanism.)

... highest quality construction—precision tapered, hardened spring contacts and contacts of copper alloy with heavy zinc coating—will deliver for a minimum life of 50,000 cycles under rated load.

Today more and more airplanes and equipment manufacturers recognize that equipment switches, space-saving Hetherington switches is really the only way to get the best of both worlds—reliability and economy. So don't miss the opportunity to get the best of both worlds—reliability and economy. So don't miss the opportunity to get the best of both worlds—reliability and economy.

also...

Indicator lights • Switch-
driven light assemblies •
Relays • Aircraft and
Electrical Equipment
Assemblies

HETHERINGTON

SHARON HILL, PA.

West Coast Division: 8548 W. WASHINGTON BLVD.
CULVER CITY, CALIF.

section, will be the nation's first radio surveillance to use the signal of a standard radio broadcast station, says North Central. The station is awaiting Civil Aeronautics Administration approval.

The interesting, 42 miles southeast of the town's airport, is made by the airport's beacon beam and signals from Rhineland's radio station, WDRF, which is located at an angle of 50 deg. A pilot, bearing in on the beam (340-deg. bearing), can tell that he is 42 miles from the field when his radio beacon, tuned to WDRF, shows a 50-deg. separation. He then repeats his location from the 1,200-ft altitude at which he was flying.

North Central hopes that with establishment of the Surveillance experiment, CAA will lower limits at Rhineland Airport from its present 700-ft minimum to a 400-ft minimum and allow straight-in approaches instead of the currently required lengthy procedures taken during IFR landings.

FILTER CENTER

• **British Adopts ARC-52**—Navy's new UHF transmitter, the AN/ARC-52 developed by Collins Radio Co., has been adopted for use in all future British military aircraft, according to reliable reports. Equipment will be made in Britain by Plessey International, Ltd. They presently is undecided whether to adopt the ARC-52 or USAF's ARC-14, selected by RCA (AW July 26, 1954, p. 34).

• **Thompson's Boston Symposium**—Air Navigation Development Board is sponsoring a symposium on the new radio navigation system May 18-19 in Washington to acquaint instrument aviators with the problems involved in the design of reliable equipment.

• **USAF Seeks Transducer Automobile**—Air Force is seeking industry bids for the construction of a small automobile factory facility for manufacturing transducers, particularly using the low-voltage technology developed by Sylvania Electric (AW June 14, 1954, p. 55).

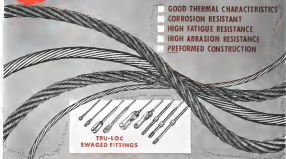
• **Wenac Seeks Author**—The Western Electronics Convention, dated Aug. 24-26 at San Francisco, is asking authors to give technical papers. Interested persons should submit a 200-word abstract together with either a 2,000-word summary or the complete text to Dr. Wm. A. Folson, Chairman of the Technical Program Committee, c/o Central Electric Machine Lab, Palo Alto, Calif. Closing date, May 1. —PK

ACCO
products

NEW "NO-MAG"

NON-MAGNETIC AIRCRAFT CABLES

- GOOD THERMAL CHARACTERISTICS
- CORROSION RESISTANT
- HIGH FATIGUE RESISTANCE
- HIGH ABRASION RESISTANCE
- PREFORMED CONSTRUCTION



TRU-LOC
SWAGED FITTINGS

Eliminates Instrument Interference!

ACCO, originators of **Engineered** cable and swaged, swaged terminals for aircraft cable use and many other important fields in the aircraft cable industry, announce the development of a new non-magnetic cable to eliminate another of the problems that have plagued aircraft designers for years. This new cable, named "NO-MAG," has these characteristics:

Non-Magnetic Properties...
"NO-MAG" cable is made from type 305 stainless steel. This steel remains non-magnetic after severe cold working—in contrast to standard stainless steel aircraft cable which shows a pronounced increase in magnetism after swaging, wire drawing or other cold working operations.

The non-magnetic property of new "NO-MAG" cable eliminates the possibility of instrument interference caused by cable magnetism.

Corrosion Resistance... New "NO-MAG" cables have corrosion resistant qualities similar to, but

slightly better than, cables made of standard stainless steel.

Good Thermal Characteristics...
The thermal expansion characteristics of new "NO-MAG" cable are much closer than those of standard stainless steel or carbon steel cables to the characteristics of aluminum alloys used in making aircraft. This greatly simplifies maintaining cable tension under various temperature conditions.

High Fatigue Resistance... Engineered construction and careful processing gave new "NO-MAG" cable high fatigue resistance, as established in extensive testing procedures.

High Abrasion Resistance... New

"NO-MAG" cable shows greater abrasion resistance than standard stainless steel aircraft cable.

Tensile Strength... While lower than that of stainless steel or carbon steel, it is sufficient to enable maintaining tension, even for use with "NO-MAG" on many applications where the characteristics of "NO-MAG" are required.

Use with Swaged Terminals... Swaged terminals can be applied to standard ACCO dimensions.

Complete Range of Sizes, Construction... New "NO-MAG" cable is furnished in sizes from 1/8" to 1" in all of the constructions found most desirable for aircraft use.

Get the complete story on this new technical development for the aircraft industry. Write today to Detroit office.

ACCO



Automotive and Aircraft Division
AMERICAN CHAIN & CABLE

Aircraft
Cable
Swaged
Fittings

801 Shipman Building, Detroit 2
2130 So. Gervais St., Los Angeles 12 • Philadelphia 2, Pa.

NEW AVIATION PRODUCTS



One Man Works Airline Stair

Flightstar, Inc., is a one-man-operated, 1,500 lb. video passenger handling stair with an 8 in. adjustable platform range.

Steps, step stringer and platform are an integral, formed and welded steel plate unit. Design is said to conform to recommendations of the National Safety Council pertaining to stairways.

Hand pump actuates two cylinders to raise the platform. Stair and platform rotate slightly about pivot pins just above the bottom step. Maximum deflection from horizontal is 15 deg. Flightstar Manufacturing Co., Van Nuys, Calif.



Magneto Tester Is Portable

A new portable magneto particle inspection kit that weighs only 13 lb. and requires no current, makes it possible to investigate part failure in service or inspect parts during manufacture.

Purchasers of the device include Miller Helicopters, Inc., Palo Alto, Calif., and Spartan Aircraft Co., Tulsa, Okla.

The Soapstone detector is a permanent magnet with left jaws and a number of self-adjusting magnetic pins to give good contact as the pin being checked. The device is placed in contact with the component being inspected and the pin is sprayed with invisible solution or magnetic powder, which coats with the lot. When the particles gather on the surface, flaws are indicated.

The kit includes a check piece with known surface and schematic flow of various depths to determine whether the unit needs reorganization. The set comes in an 8 1/2 x 6 in. carrying case.

Rice-Peterson Sales, Inc., P.O. Box 1114, Palo Alto, Calif.



Miller Haa High Feed Rate

High rates of work table feed and wide range of spindle speeds make new Electron, Carlson No. 5VA Vertical particularly adaptable for milling of difficult aluminum alloy parts, the manufacturer states.

Cross and longitudinal table feed ranges are from 0.250 to 100 in./min. in two stages, continuously variable in each stage. Vertical table speed range is from 0.50 to 38 1/2/min. Spindle speed range is from 72 to 2,480 rpm, using the 32 hp spindle drive motor.

Maximum vertical travel clearance is 19.5 in. and maximum and minimum distances from spindle to bore centers are 8 and 30 in. respectively. Work table is 20 in. long and has a 13 in. cross feed. Table will tilt 30 deg. toward or away from the operator.

Electron, Carlson & Co., Rockford, Ill.

Rivet Cooler Holds 50 Cores

New 5-in. dia. rivet cooler for aircraft use has room for 90 fuselage connection. The cooler operates efficiently at a temperature of about 50°, the manufacturer reports.

Model RSZ103 has heliowelded 8-lb. hermetic compressor with fluocarbon condenser and operates on 115-220-v. a.c., 60-cycle, single-phase current.

Other models RSZ153, is a 1 1/2 Sec. R-experts cooler that can operate at low as -90°, down to -95° when run continuously in reverse when temperature, model RSZ153, is a 5-oz. ft. unit, can operate at -80°. These two models are equipped with an auxiliary lid that maintains heat losses while the main lid is open.

Revo, Inc., Dearfield, Mich.

AEROJET-GENERAL ENGINEERING, CHEMISTS, ELECTRONIC ENGINEERS, MECHANICAL ENGINEERS, PHYSICISTS, AERONAUTICAL ENGINEERS.



HIGHER PAYLOADS and HIGHER PERFORMANCE

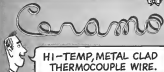
This compact, light-weight rocket powerplant, designated by the U.S. Air Force as the 1B23-AJ-1 liquid-mono-fuel rocket, has been successfully flight-tested on the Republic F-84F airplane. Used for assisted-takeoff, this powerplant and its big brother, the 1B24-AJ-1, which was extensively flight-tested on Boeing's B-47B Stratofortress during 1954, have proved the practical applicability of rocket power to piloted aircraft.

SOLID AND LIQUID-PROPELLANT ROCKET POWERPLANTS FOR AIRCRAFT AND AIRCRAFT APPLICATIONS • AIRCRAFT THRUST REVERSERS (OMCA) • AUXILIARY POWER UNITS AND GAS GENERATORS • ELECTRONICS AND DISTANCE • CORONA SCOTTS • EXPLOSIVE ORDNANCE AND WAR HEADS • UNDERWATER PROPULSION DEVICES • ARCHITECTURE SERVICES FOR TEST FACILITIES

Aerojet-General CORPORATION
A Subsidiary of THE GENERAL TIRE
The General Tire & Rubber Company
ATLANTA, CALIFORNIA
CONCORD, CALIFORNIA
SACRAMENTO, CALIFORNIA

MORE POWER FOR AIR POWER

WHAT IS "CERAMO"?



54's "Ceramo" wire consists of thermocouple material conductors, surrounded by magnesia-oxide insulation, with an outer metal cladding overall.

Thermocouples, or extension leads of "Ceramo" wires will fit into openings that are too small for most ordinary thermocouples or extensions. Furthermore, they can be formed easily to any configuration without thermocouple-type lead. "Ceramo" can be bent as a cable as well as in its own diameter. The flexibility of the outer metal tube makes contacts unobtainable. But even a thinner wire will store it; in fact, it will withstand pressure up to 40,000 psi. These metallic clad wires have excellent resistance to high temperatures, oxidation, corrosion, petroleum products, steam, radiation or shock.

"Ceramo" thermocouple wires are made in four construction, Chromel-Alumel, Copper-Chromel, Chromel-Constantan, and Platinum-Platinum-Rhodium. Wires are furnished with standard tubing of stainless steel, Inconel, titanium, or copper. Made with 30, 32 and 36 gage conductor material, overall diameters of 1/16", 1/8", and 1/4" respectively, lengths up to 20 ft.



"Ceramo" thermocouple extension wires are made in four construction, Chromel-Alumel, or Copper-Chromel with copper-clad alloy, plus an optional cold lead down steel sheath overall. Made with 30 and 36 gage conductor material, overall diameters of 1/16" and 1/4" respectively, lengths up to 2000 ft, depending on the type of metal tubing and outside diameter. "Ceramo" is made also in single conductor or multi-conductor cables.

Interested? Write for Bulletin 31-200-C

Pyrometry • Temperature Monitoring Systems • Thermocouples • Protection Tubes
Quick-Coupling Connectors and Panels • Thermocouple and Extension Wires

Thermo Electric Co., Inc.
SADDLE RIVER TOWNSHIP, ROCHELLE PARK POST OFFICE, NEW JERSEY
IN CANADA—THERMO ELECTRIC (Canada) Ltd., BRAMPTON, ONTARIO

ALSO ON THE MARKET

Low-hydrogen electrode for alloy and mild steels. Stikrony LH-1, has powdered metal added to coating. Deposition rate is 63% faster than conventional electrodes, the maker claims—General Electric Co., Schenectady 5, N. Y.

Hydraulic hose designed to operate at 5,000 psi and temperatures over 400F, and to carry all known synthetic or petroleum-based fluids. Fluoroflex-T 18706 now is available for field testing in 1/2 in. and 1 in. sizes, 1/2 in., 3/4 in. and 1 in. hose will be available soon—Kosulac Corp., Buffalo, N. Y.

Electrodynamic shaker system for vibration testing develops 160 lb peak force output over 49,500-ops frequency range and displacement amplitudes exceeding 9.4-in. peak-to-peak in the 5-40 cps range. Designation is "G8" system—Caldyne Co., 120 Court St., Woburn, Mass.

Mach-N-Coast machines are available at the same time as it commences production items. Pace with one standard step, 5-9 50 amp, 60-1-Mp Engineering Co., 4035 Lexington Blvd., North Hollywood, Calif.

Hydraulic test stands for aircraft engines and government applications are combined with impedance test systems as package installations to provide compact facility.—American Research Corp., 11 Brook St., Bartol, Conn.

Toolset like punches for fitness are claimed to have life 100 times longer than ordinary tool-and-die set. Toolset, Division of General Riveter, Inc., Buffalo, N. Y.

Glass-Tread is bulky but for safeguarding critical work, saves from dust and dirt tracked in on shoes.—Merr Paper & Chemical Corp., Cambridge 40, Mass.

Noise barrier curtain, a specially treated flame-resistant loop, is designed to reduce high noise level. Transcend curtain is chain spaced and supported by steel top plates operating on rollers which are in a standard track. Available in several colors—Brown Sh. Bag Co., Physical Research Dept., 325 27th Ave., N. E., Minneapolis, Minn.

Nylon cord airplane line has flat profile, wide rib and new construction giving up to 20% longer life. Manufacturer claims Transdome Sky Chaps Nylon Grip Cord—Firestone Tire & Rubber Co., Akron, Ohio.

LOUD

Mass Produces complex structural fittings



Makers say aircraft require lighter, stronger structures to cope with the higher loads encountered at speeds above Mach 1. The elimination of a single structural joint will often contribute a savings of many pounds in a highly loaded member. The result has been the trend to longer and more complex single structural fittings. Loud has made over 15,000 landing gear truss arm fittings which is an excellent example of mass producing a tough job while maintaining a high degree of quality.

CASE HISTORIES

Today's airplane is being built out of huge forgings rather than fabricated sections. The spar fitting which maintains leading gear truss arm support and wing spar into one single forged and machined fitting is representative of pieces of hardware. Although the fitting is over 6 feet long, it is machined on Loud's 120 inch Cincinnati hydraulic. Advances in design create more complicated machined operations.

The maximum utilization of facilities is illustrated in the final welding of a stabilizer boom. The change from the previous bolted joint design saved over 30 pounds per airplane in addition to saving considerable cost and providing a stronger fitting.

"PRODUCING TODAY TOMORROW'S AIRCRAFT REQUIREMENTS"



H. W. LOUD MACHINE WORKS, INC.

91 EAST SECOND STREET, DEPT. 10 • POMONA, CALIFORNIA

See Loud's design and engineering capabilities. Request Loud's engineering literature. Write to: Loud Machine Works, Inc., Dept. 10.

National Sales and Service for Loud Machine Works, Inc. in the West. Write to: Loud Machine Works, Inc., Dept. 10.

Authorized Sales Engineers throughout the United States. Write to: Loud Machine Works, Inc., Dept. 10.

ENTER NOW! THE MOST EXCITING CONTEST IN HISTORY
TO CELEBRATE 30 YEARS OF AIRLINE SERVICE!

TWA's \$100,000 COSMIC CONTEST

\$50,000 NOW... \$50,000 IN 1985

It's easy! It's fun! It's actually two contests in one. You can enter one or both parts . . . win both first prizes for a grand total of \$80,000. And you can start right away because the entry blank to Part 1 is on the opposite page!

There's never been such a contest before! Just think what you could do with one of the big cash awards! Was you could pay off the mortgage, send the children to college, and still have plenty of money left over for travel to all those enchanting lands you've always dreamed of seeing some day. When's more, you may even win the big \$50,000 cash prize in 1985 by entering Part 2 of TWA's Cosmic Contest!

So get busy this minute. Think of all the wonderful things you like about traveling by airplane, and why TWA is the way to fly. Read the type on how to win both parts of this exciting contest printed on this page. Then fill in the official entry blank for Part 1 in this advertisement and mail it promptly. In a few days, you'll receive your official entry blank for Part 2, and another chance to win even more money!

30 CHANCES TO WIN RIGHT NOW!

1st PRIZE	\$50,000
2nd PRIZE	8,000
3rd & 4th PRIZES	2,000
5th through 10th PRIZES	1,000
11th through 30th PRIZES	250

\$50,000

There is only one 30-day deadline in the following drawing: in 30 additional months of fun. While it's the way to go, and TWA is the way to fly.

Women will be considered on an equal basis September 30, 1985.

\$50,000 IN CASH!

To be awarded 30 years from now in 1985!

Here's how to enter Part 2 of TWA's Cosmic Contest. When you mail us your entry for Part 1, you will send you a special entry for Part 2. On this form, write in 200 words or less what you think commercial air travel will be like thirty years from now. TWA's Cosmic Contest will be held in 1985. Your entry will be entered in a special drawing to select the winner. TWA's Cosmic Contest will be held in 1985. Your entry will be entered in a special drawing to select the winner.

TIPS ON HOW TO WIN PART 1

Simply think of all the many reasons why you'd like to travel by TWA. Think of the many reasons why you'd like to travel by TWA. Think of the many reasons why you'd like to travel by TWA. Think of the many reasons why you'd like to travel by TWA.

TWA has put a two-week vacation in Europe, any month of the year. TWA has put a two-week vacation in Europe, any month of the year. TWA has put a two-week vacation in Europe, any month of the year.

TWA's voluntary members in exchange of the free world to help to organize their own efficient service but help provide training between the 12, 13 and other airlines.

TWA's staff dependable service between 30-day rates on 4-6 months has established world wide facilities.

TWA's leadership in efficient, economical service has shown the way toward elimination of costly government subsidies with great results in 1985.

TWA's leadership in passenger and technical advances, the great feat of Concorde aircraft and the skilled, courteous personnel have set new standards of speed, comfort and dependability in air travel.



OFFICIAL RULES FOR

TWA's COSMIC CONTEST

1. **TWA's Cosmic Contest** consists of two parts. You may enter either one or both parts. Entries for both parts of the contest must be postmarked on or before July 31, 1985 and received no later than August 31, 1985. The entry for Part 1, simply entitled "TWA's Cosmic Contest," will be received by the TWA office at New York, New York, 10019, on or before September 30, 1985. The winner will be announced before July 31, 1985.

2. **Official entry** in this contest is one word. It is the word "TWA" which you think commercial air travel will be like thirty years from now. TWA's Cosmic Contest will be held in 1985. Your entry will be entered in a special drawing to select the winner.

3. **Official entry** in this contest is one word. It is the word "TWA" which you think commercial air travel will be like thirty years from now. TWA's Cosmic Contest will be held in 1985. Your entry will be entered in a special drawing to select the winner.

4. **Official entry** in this contest is one word. It is the word "TWA" which you think commercial air travel will be like thirty years from now. TWA's Cosmic Contest will be held in 1985. Your entry will be entered in a special drawing to select the winner.

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7. **Official entry** in this contest is one word. It is the word "TWA" which you think commercial air travel will be like thirty years from now. TWA's Cosmic Contest will be held in 1985. Your entry will be entered in a special drawing to select the winner.

TIPS ON HOW TO WIN PART 2

Here's what some people think air travel will be like in 1985. It's so much fun to imagine what flying will be like in 1985. Just think about it. Here's what some people think air travel will be like in 1985. It's so much fun to imagine what flying will be like in 1985. Just think about it.

For example, a *Newsweek* may write, "In 1985, I think aviation will be like this. It will be possible to fly the way from Los Angeles to London without stopping. I will have just 6 hours and 10 minutes to sit in an airplane that looks like a flying saucer, with no wings or tail and no huge cabin that is divided into many private bedrooms. This will be no economy or expensive because these planes will be self-stored up and fold like helicopters. The average speed of these planes will be about 3000 miles an hour. They'll fly about 20 miles an hour in the air. These planes will use atomic power (but will be safe) and their engines will be made of materials that last for years of years without refueling."

Businessweek might say, "In 1985, I think commercial aviation will be like this. There will be no need for airports, no need for fuel. They will fly at a altitude of 50 to 100 miles above the earth at a speed of 3000 miles per hour. Because of this speed, current engines will be designed so passengers can keep up with the rapid change in time zones. These space planes will take off straight up in the air. They will land like some huge, winged, flying saucer that resembles the gravity pull of the earth. They will have a weight of 20,000 tons, so they fly by using gravity in the world. These planes will carry as many as 500 passengers and will feature complete restaurant service, a movie theatre, audio facilities and a cable and lounge."

8. **Official entry** in this contest is one word. It is the word "TWA" which you think commercial air travel will be like thirty years from now. TWA's Cosmic Contest will be held in 1985. Your entry will be entered in a special drawing to select the winner.

9. **Official entry** in this contest is one word. It is the word "TWA" which you think commercial air travel will be like thirty years from now. TWA's Cosmic Contest will be held in 1985. Your entry will be entered in a special drawing to select the winner.

10. **Official entry** in this contest is one word. It is the word "TWA" which you think commercial air travel will be like thirty years from now. TWA's Cosmic Contest will be held in 1985. Your entry will be entered in a special drawing to select the winner.

11. **Official entry** in this contest is one word. It is the word "TWA" which you think commercial air travel will be like thirty years from now. TWA's Cosmic Contest will be held in 1985. Your entry will be entered in a special drawing to select the winner.

12. **Official entry** in this contest is one word. It is the word "TWA" which you think commercial air travel will be like thirty years from now. TWA's Cosmic Contest will be held in 1985. Your entry will be entered in a special drawing to select the winner.

13. **Official entry** in this contest is one word. It is the word "TWA" which you think commercial air travel will be like thirty years from now. TWA's Cosmic Contest will be held in 1985. Your entry will be entered in a special drawing to select the winner.

14. **Official entry** in this contest is one word. It is the word "TWA" which you think commercial air travel will be like thirty years from now. TWA's Cosmic Contest will be held in 1985. Your entry will be entered in a special drawing to select the winner.

15. **Official entry** in this contest is one word. It is the word "TWA" which you think commercial air travel will be like thirty years from now. TWA's Cosmic Contest will be held in 1985. Your entry will be entered in a special drawing to select the winner.

16. **Official entry** in this contest is one word. It is the word "TWA" which you think commercial air travel will be like thirty years from now. TWA's Cosmic Contest will be held in 1985. Your entry will be entered in a special drawing to select the winner.

17. **Official entry** in this contest is one word. It is the word "TWA" which you think commercial air travel will be like thirty years from now. TWA's Cosmic Contest will be held in 1985. Your entry will be entered in a special drawing to select the winner.

18. **Official entry** in this contest is one word. It is the word "TWA" which you think commercial air travel will be like thirty years from now. TWA's Cosmic Contest will be held in 1985. Your entry will be entered in a special drawing to select the winner.

19. **Official entry** in this contest is one word. It is the word "TWA" which you think commercial air travel will be like thirty years from now. TWA's Cosmic Contest will be held in 1985. Your entry will be entered in a special drawing to select the winner.



When an electrical system requires a reliable Direct Reading Frequency Meter—check VARGO. This ruggedly built Frequency-Dial Meter and Control Box is accurate to $\pm 0.5\%$. It meets all military environmental specifications and no temperature correction is required. A precision stainless steel fork is used as the reference standard, and the built-in indicator can be used simultaneously for chart recordings where permanent record is desired. The 400 cycle calibration on the meter face is offset from dial position to cause actual indicator movement for more positive calibration.

Compact and light in weight, the VARGO Frequency Meter is ideally suited for either airborne or ground power conversion.

Frequency Standards	Electronic Inverters
Frequency Changers	Regulated Supplies
Voltage Regulators	Speed Controls
Voltage and Frequency Sensitive Relays	



The JRD 2 Ground Power Equipment designed and manufactured by Joseph Aircraft Corp. is used by the Air Force to check out aircraft on the flight line. The VARIO Frequency Alar is utilized as part of the system to provide accurate and reliable measures around 400 radio channel systems.

VARO MANUFACTURING CO., INC.

INPUT: 110 to 130 Vrms AC
250 to 400 cycles (Water cell damaged at 250 cycles)
25 Vrms DC at 1 ampere

OUTPUT: Water scale collected at 120 intervals between 250 and 400. Polaris indication high to low near the center of 350 to 450.

CONTROL SECTION	INDICATION SECTION
Height: 4 inches	Standard meter scale per ASTM 10000 (see center)
Width: 1 1/2 inches	Registered instrument
Depth: 7 inches	Only dimensions 2400 and diameter and 1400 depth. Width: 16 mm
Weight: 3 lbs., 16 oz.	

Representatives: Ann J. K. For Hills Branch, Dayton, Ohio, Pacific Scientific Co., 1430 Grand View Ave., Los Angeles 39, California

a new truck, and conversely within the ground pattern so we know the new truck affects the displacement from whatever can be written to follow. In mathematical language, he manipulates a cube, establishes a new rule, and in the right moment, it is where the displacement is zero, under the rule and the cube are zero. In other words to close and hold a closed park, he must use those things simultaneously, displacement, rule and structure, and if he cannot do so, his structure will be unstable and he will return from rule to rule.

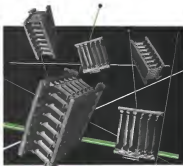
The deployment system failed because it puts the emphasis on displacement information instead of on rate information, and to make matters worse, presents this displacement information in an unusual manner.

It may say not be relevant to the alleged accident to reveal that that if the pilot, when on the flight deck, continuously wears the lines of the parachute in position, (1) a difficult job has been made of him, (2) he is forced to go to the cockpit to get the lines to avoid going to become paralysed from lack of movement in ordinary life; then he will stopper his sight of descent to 2 deg. in order to make the perspective angle easier on the eye; a man would do if the lines of lights were parallel. It is true that this is proved or two the accident effect does not theoretically show him that he is low, but due to the difficulties of interpretation, and the strangeness of the accident, the salience of what a wrong way come the line

Visual Analogies: The process by which the pilot extracts raw information from the system at the onset of the motion, but Myrman's last sentence does not give me the impression that he fully understands it over other inquiries. Another last sentence to replace positive evidence is that he talked to the system, a linguistic, is subjective in direction, at this linguistic point we see in Gert Bittner point out: the analogies between hand and internal work which could be noted by this sentence. Is the space the "visual element" is "valley effect" covered by most computing time, the space growth in combination with possible loss the network.

[illegible]

► **Cavitation System**—A cavitation approach lighting system without cavitation is usually a defective pattern, and there have certainly been accidents with this, but, as far as I know, there has as yet been no accident incident when approaching on the full center line and similar pattern, although this pattern has been fully operational at London since November 1943, and as one or other

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For Borker's original, informative Vancouver map, "A Map of Selected Regions" Within the Area of the River at an end



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• LETTERS •

all as before, is widely used throughout the world.

Mr. Pearson knew his clients on the test at Accra, but these tests have to be conducted with a certain amount of insight.

I myself took part in the tests at Accra during those weeks, and on quite a few occasions stood behind the pilots and watched them land in violation of the rules of left rule. It is common knowledge that landing success in these conditions is determined mainly by skill in instrument flying, and the Accra pilots were certainly very skilful.

I can quite certain that none of the present lighting systems installed there (and in the last several there included the runway line and center-line system) provided more than momentary information, and even that only for a few seconds. The reason for the lack of guidance even when the lights are in view is that the indication disappears from any system of visual aids before the displacement indications. In other words, the pilot may be able to see where he is, without being able to see where he is going.

The geometry of the rate indications becomes very modified when the visual range falls below 100 yards, and since good rate indications are necessary for a safe descent, it is not operationally possible to land in lower visibilities (see visual aids) without having the safety factor far below what can be accepted as being acceptable.

• **Point of the Pudding**—Much work has been done on approach curves by the Sperry Corporation in the U.S.A., and by the Royal Landing Experimental Unit in the U.K. (see paper by J. F. Mason, "A Quantitative Study of Instrument Approach," J. Roy. Aero. Soc., 53, 85). Further information on the rate theory of visual guidance can also be found in my own paper entitled "Visual Reference in Motion," published in *Twentieth Century Navigation*, July 1956. These two papers give figures for the approach curves actually achieved in the field with various combinations of electronic and visual aids, and Mr. Pearson would do well to ponder on these, for they provide the final and incontrovertible proof that he is mistaken.

There is one useful as shewers to thought, but in operational matters the final point of the pudding is the eating.

E. E. G. CUMMERS
Room 5100
Upper Park Road
Cirencester, England

Scientist Shortage

AMERICAN WIRE should be commended for its thorough exposition of "Scientist Shortage Threatens Defense" (Mar. 22, P. 32).

I feel that the most successful way to attract youth to the present scientific and engineering fields is in the form of a challenge. My personal reason for studying aeronautical engineering was because I felt it was a great challenge. I imagine that others entered the associated engineering field for the same reason.

JOHN L. LACROIX
Flight Safety Foundation, Inc.
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New York 22, N. Y.

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EQUIPMENT

Direct Injection Cuts Fuel Consumption

By George L. Christian

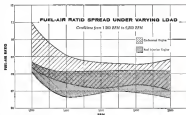
Vegeance, VT.—Direct fuel injection on aircraft engines in the low to medium horsepower bracket is made possible by a new fuel pump now going into production at Semmons's Aerochemicals manufacturing facilities here.

Designed for use on aircraft and helicopter engines in the 200-800 hp range, the pump has been selected for production on three Continental Motors powerplants—AV80-1790-G, AV1-1790-1 and AC80-991-5, and is being prototyped for many other fixed- and rotary-wing aircraft engines, among them the Jacobs J755 and Pratt & Whitney Aircraft's R885 and R1340.

► **From Tanks to Pumps**—The pump, which is the heart of the Semtex 5 U Fuel Injection System, has been in production at Semtex for four years in a tank and carburetor vehicle engine fuel injection pump.

Design of the aircraft test is essentially the same as the automotive vehicle pump, installed on over 1,000 engines, according to company engineers.

Seconds resistance, the pump outlet flow increases with the S. 41



GRAPH SHOWS ECONOMY of direct injection compared to reflection in combustion tank engine operations. Same applies to 180-600 hp aircraft piston engines.

Carbaxeter Co., Ltd., Birmingham,
England

► **Economy and No being-Two** of the more attractive features of the Semmonds S. U. system are: 5-10% fuel economy throughout the engine's operating range, and the fact that the system's

it rains don't count we up, except
weekly at the mist.

Injectors systems are inherently more economical than carburettor systems, according to Siemens spokesman, the pump allows the engine to deliver up to 3-10% more power for the same displacement.

long longer—a very real barrier to single-engine aircraft especially—is eliminated by eliminating the carburetor, whose venturi is the critical icing point. The injection pump sprays only a battery valve-type throttle in the exhaust just ahead of the intake manifold.

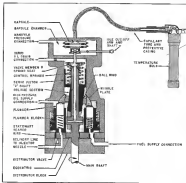
Carburetor elimination also eases need for carburetor pre-heat controls, strong spare seat weight, and grade engine power loss due to carburetor icing.

• **Good for Helicopters**—Swanlund engineers say that the S U injection system are particularly good for use with helicopter powerplants. The fuel with its anti-foaming additives is injected directly into the cylinder just ahead of the intake valve.

With standard, carbonite- and manifold-type fuel induction systems, additives tend to deposit themselves along the manifold's walls or to be centrifuged out by the blower if the engine is overbored.

Another advantage of the injection systems. Fuel distribution to all cylinders is uniform and manifold design is simplified.

Special Features—The S. U. injection system incorporates several features not found in other aircraft engine injection systems. The injection nozzles are located in the intake manifold directly ahead of



3. 5. RAMP recovery shows slight compounds, temperature half, feed conversion

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A New 16-Page Brochure describes and pictures in detail the facilities of Plant 3, where Allied produces precision-hardened steel ground parts. Included is a complete listing of all equipment in use. A copy will be sent you immediately upon request—without obligation, of course.

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PLANT 2
Schematic, 1960



PLANT 4
Billrodt, Mich.

each cylinder's intake valve. Keeping the nozzles out of the high-pressure and extreme heat of the combustion chamber means the system can operate at relatively low pressures and the nozzles themselves no longer need be high-pressure components with carefully finished neck portions.

Through a low-pressure system (nozzle neck pressure is approximately 60 psi, port pressure was about 170-180 psi) results in longer pump life, less lifting weight, and greater system reliability, says Sorenson.

Nearly 90 percent of S. U. pump parts are interchangeable. To modify a pump from a six- to a nine-cylinder engine, he reasons, requires changing only four pump parts. High interchangeability cuts inventory requirements.

► **Easy Cold Start**—The Sorenson system allows engines to be started easily with no preheat or temperature down to -65°F, a little hand priming is all that is needed.

Sorenson engineers told Avionics Week that in some cold-weather starting trials, the only engines which could start at all were powered by the Sorenson system.

Elimination of preheat requirements simplifies logistics and enables aircraft to become airborne faster.

The S. U. injection system does not require "boost" discharge lines—all fuel

lines leading from pumps to cylinders do not have to be the same length for even fuel distribution.

► **Saves Weight**—Continental Aviation and Lycoming Corp. reports that in an installation in use of its 100-hp auxiliary engine, there was a saving of 30 lb. with the engine equipped with an S. U. fuel injection system as against the same model engine equipped with a carburetor. S. U. pump and nozzles in this installation weigh about 7 lb.

► **How It Works**—The pump sends to each three functions of the engine (nonsequentially): rpm, manifold pressure, and manifold air temperature.

The pump knows the engine's rpm, since it is connected directly to the accessory system. A connection between the engine's manifold and the pump's capsule chamber feeds manifold pressure to the pump at all times. A non-perforating link, located in the engine's intake manifold, transmits temperature of air taken in by the engine to the pump through a sealed line containing dry nitrogen.

Specialized application pumps for supercharged engines are available in prototype.

► **Increase Power**—When the pilot calls for increased engine power, less is lost happens.

As he opens the throttle, manifold pressure increases. This pressure tends

to compress the capsule in the capsule chamber which in turn moves the pin shaft up, allowing high-pressure oil to flow through a passage in the main shaft and dump into the servo oil chamber. (X) servo controls oil outflow because of a restriction in the outlet passage.

Result is reduced differential pressure on both sides of the "Z" shaft, which allows "tuning springs" to move the Z shaft downward, increasing the angular displacement of the wobble plate, which lengthens plunger travel to increase pump output.

The Z shaft is a one-piece, attached, dielectric casting, composed of a servo cylinder on one end, which carries the tuning springs, a linked rod to engage lobe of main shaft, and a control base for main shaft. The wobble plate, a control to the eccentric Z shaft by means of a ball. Axial motion of Z shaft governs amount of fuel injected, rotation moves wobble plate radially so engine cylinders get fuel in proper sequence.

► **Decrease Power**—At throttle is retarded, manifold pressure drops, which allows capsule in the pump to expand and move the pin shaft down. The result is the servo valve closing off high oil pressure, reducing pressure in servo of chamber.

High-pressure oil moves the Z shaft upward against the tuning springs which reduces displacement of the wobble



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FUEL-AIR MIXING takes place in intake manifold ahead of intake valve in Sauerbrey S.U. direct injection system.

plate, shortens plunger stroke, reducing pump output.

► Fuel Flow—Fuel timing is controlled and tuned by a rotating distributing valve which is the single moving part in the distribution system. Wobble plate and plungers do not rotate. Elimination of all auxiliary distribution controls such as check valves removes the source of many potential troublesomeness, according to Sauerbrey engineers.

The distributing valve has the advantage of tuning the fuel to be injected into the engine during a full 180 degrees of crankshaft revolution. This means that fuel is drawn into the combustion chamber by the piston through its complete travel from top dead center to bottom dead center of its intake stroke. While the distributing valve controls fuel, timing the pump's plungers control volume of fuel injected into the intake ports.

A quick shut off feature, either manually or solenoid controlled, cuts pump fuel flow immediately for engine shutdown.

► Special Applications—When the pump is used on a supercharged engine, a piston is added between the plungers and the pin shaft which biases the plungers as a function of added ambient air pressure. Action of the piston increases fuel delivery proportionately as altitude increases to compensate for the increased air mass flow due to reduced back pressure on engine exhaust.

At high rpm, intake valves have a throttling effect as the air being taken into the combustion chamber. By using increased pressure in the supercharger, resulting from high rpm, pump pressure is reduced to maintain a substantially constant fuel/air ratio. Sauerbrey expects to produce the pump at a cost competitive to that of a carburetor, in production quantities.

Anti-Splash Valve Seals Tank Vents

A new anti-splash valve which prevents fuel from sloshing out of aircraft fuel tank vent lines is currently being used on the Avco CF-100 bomber.

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VALVE valve fuel tank vent-line splash.

temperatures, according to the valve's manufacturer.

The Model 21 1949 valve is particularly useful in wing tanks, where tank geometry often requires that vent line inlets be installed almost at fuel level. The valve, through the action of two float-actuated, opposite-acting poppets and two governors, keeps fuel lines unclogging during aircraft maneuvers and periods of high acceleration.

One governor is sensitive to centrifugal acceleration, the other to negative G's. Combined action of the governors and float prevents fuel from siphoning through fuel vents.

Manufacturers: Aero Supply Manufacturing Co., Inc., Conyn, Pa.

New Generator Brush Better, AA Finds

Aircraft generator systems life on American Airlines' Convair 440s and Douglas DC-6s has been increased at least 100% by installing a redesigned brush which performs well at low and high altitudes and a shielded housing which will not arcing in its housing.

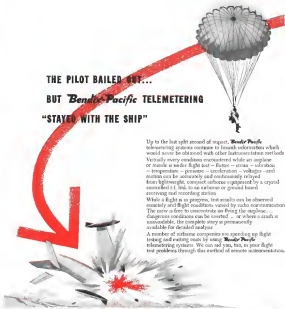
When originally installed in 1946, the equipment had an expected development life of 700 hr. This has been extended to 1,400 hr. on the 24V and 1,800 hr. on the larger planes. The improvements on which General Electric Co. relied, allow AA to schedule electrical component overhaul in line with its engine overhaul schedule.

Platinum Electrodes Stretch Plug Life

Platinum-platinum electrode spark plugs are giving twice the life of reserve electrode plugs when used in Wright Turbo-Compound R-119 engines, according to AC Spark Plug. The fine wire plugs show only slight plug wear and no carbon at lead depths when removed from Turbo-Compound engines after 400-500 hours of service, says AC. The plug uses a silver center electrode with a gold-plated platinum tip, while side electrodes are all platinum.

AC says it has received substantial orders from two major commercial airlines and the USAF.

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SAFETY . . .

Design was based. It was still attached to the drive shaft and was not supported. Approximately 1/2 of the circumference of the barrel and one edge of the bearing were out, damaged, and refit.

The generator drive shaft was broken just at the clutch assembly. The drive section of the shaft, designed to fail under excessive loads, was intact although bent one degree. The structure and component components of the generator were severely scored, distorted, and burned. The noise made on the generator matched exactly on the coils and magnets and were addressed as a generator, which indicated they were made while the generator was still being.

According to company records the generator had accumulated 510 flight hours since overhaul. The overhaul included its placement at the base being.

Investigation further disclosed that the Douglas C-54G electrical system originally consisted of four 100-amp generators, one installed on each engine.

The system was subsequently modified as the subject aircraft by the order to level of a two 100-amp generator system a generator installed on Number 3 and Number 1 engine. The modification was made in accordance with a CA-approved Data-C-54G Air Line engineering order Number 536, dated July 29, 1946. The modification was made to provide a more efficient generator system for the aircraft. In the specific instance of N 13070 the modification was completed and approved Nov. 13, 1953.

Generation specified by the engineering order was designated as Type G-27. It was found through testimony of the more technical representative that the G-27 generator, the type installed on the Number 3 engine, was identical with the generator specified in the engineering order issued by the engine.

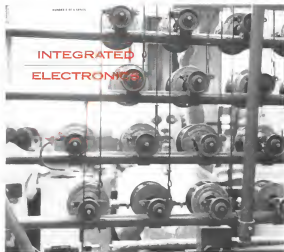
After World War II, a number of G-27 generators, both new and used, were received by the Air Force, both and the Air Force, in order to identify those new engines which were not, both as to make and warranty, designated those as the G-27 generator.

Extensive examination was conducted relative to the engine, the other engine, and the engine, and although these examinations were fully changed from aspect and no evidence could be found of modification or failure prior to impact. The case stated that prior to the fire the engine experienced no mechanical or structural deficiencies.

ANALYSIS

Investigation and examination of the wreckage definitely indicated that the failure of a generator bearing was the initial and basic cause. This failure resulted in the generation of extreme frictional heat capable of weakening and burning through adjacent fuel lines causing the release of inflammable fluids which were ignited. The fire progressed so rapidly and became so intense that available CJD was insufficient to extinguish it.

The failure of the generator drive shaft to show of its designed shear section after the bearing failure, prevented the generator from rotating further and the re-



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SAFETY

loss of inflatable fluids with consequent serious fire.

The loss of all electrical power at the time the engine separated from the aircraft was most probably caused by a ground fault on the power cables during the violent landing of the aircraft outside base. Further cable contact with the Gage INSAC and one of electrical landing lights was prevented by electrical power loss.

The landing was made on the airport all the runway due to the radiator-type engine lights being obscured by a growth of tall grass. The tall grass was actually around 3 ft. on either side of the runway and unless an aircraft, on approach, was lined up with a runway, the lights would not be visible from a low approach as in this accident.

The Gage INSAC communication failed but he did not lose any members of the crew the flight continued. It is possible that static and interference from other radio sources prevented him from hearing the complete message.

Before further transmission from the aircraft could be made all electrical power was lost, consequently the Gage Fire Department was not at the airport when the aircraft landed. It is doubtful that the available fire equipment would have been able to extinguish the fire had it been started and present at the base of the landing.

The Board wishes to commend Capt. Proctor and First Officer MacDonald who, under fire emergency conditions, presented a safe landing at night, with no aircraft lights and with the aircraft heavily on fire. Miss Miller, the stewardess, is also to be commended for the prompt and efficient action in which she prevented the evacuation of all passengers from the burning aircraft without injury to any of them.

FINDINGS

Upon consideration of all available evidence the Board finds that:

1. The carrier, the aircraft, and the crew were properly certified.
2. The flight was dispatched in accordance with company procedures.
3. The total weight at takeoff was 71,440 lb., which was less than the maximum all-handling and the disposable load was properly distributed with respect to the center of gravity of the aircraft.
4. The flight was routine until, when in the vicinity of Cape Olathe, the aircraft was in Number 3 mode.
5. A generator bearing failure resulted in extreme vibration loss which accelerated or forced through adjacent inflatable fluid lines and caused the fluid.
6. The intense fire caused the Number 3 engine to drop out at flight resulting in a complete loss of electrical power.

PROBABLE CAUSE

The Board determines that the probable cause of this accident was a bearing failure of the Number 3 engine generator, causing extreme vibration loss and the release of inflatable fluid which caused a flight by the Civil Aeronautics Board:

- 1. Chief Captain
- 2. Captain D. Denny
- 3. First Officer
- 4. Joseph P. Adams



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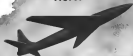
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Airline Business Continues Steady Rise

But annual reports pinpoint profit squeeze caused by higher costs; coach and credit plans boost traffic.

Annual financial reports of the nation's domestic airlines indicate that 1954 was generally a good year for the carrier. With few exceptions, strategies show increases in all categories—traffic, revenues and profits. Business was on the rise at the end of the year, and the companies predict that trend will continue in 1955.

American

American reported revenues of \$134,766,000 in 1954, an increase over 1953 revenues of \$130,300,000. Expenses were \$119,713,000. Earnings after taxes were \$14,511,000, down from \$14,104,000 for 1953. Preferred and common stock dividends totaled \$5,312,000.

Questions last year were affected by a pilot strike which postponed the airline for 34 days in August.

Delivery of 25 DC-7s was completed during the year, and orders have been placed for 14 more DC-7s and four DC-6Bs. Delivery of this order will bring the American fleet to 186 aircraft.

Aircraft flights accounted for 23% of the \$4,577,000,000 passenger-miles. American added new airlines to aircraft last year and will add two more this year.

C. R. Smith, American's president, told stockholders that costs remained stable during the year while costs increased. "At the same time, as costs at present levels, cannot long be continued on that basis it even continue to rise," he said.

United

United Air Lines had revenues of \$280,719,000 and expenses of \$178,837,000 last year. Figures for 1953 were \$177,067,000 and \$151,941,000. Net earnings for 1954 were \$9,613,000, a 6% increase over the previous year. Earnings amounted to \$7.51 a common share.

Increased traffic through introduction of the DC-7 is viewed by United as a factor which will contribute to increased revenues. At the end of the year, 91% of the carrier's services were flown by DC-6, DC-6B and DC-7 equipment.

United operated 33 aircraft in coach

service last year for 26% of total passenger traffic, an increase over 21% for the previous year. United says it will continue to expand service to keep abreast of industry trends. But the report expresses concern with the spread between first class and coach fare and the diversion from first class to coach.

■ **DC-7s:** Freshmen—launched traffic during the American Airlines strike and profitable Elman operations are total in contribution to improved revenues. United's load factor dropped slightly from 63.4% in 1953 to 66.4% in 1954 in the face of a 25% increase in available seats.

In his message to stockholders and employees, UAL President W. A. Patterson stressed that the profit squeeze had increased and the debt this would be a continuing problem in 1955, although he expressed a general optimism for the current year.

Patterson said that although United is keeping alert of developments in the air transportation and airport field, it appears that such support in the DC-7 "will be the airlines' 'breakthrough' for some years to come."

Colonial

Colonial Airlines had a profit of \$90,945 in 1954, compared with \$128,465 in the previous year. This is the first time Colonial has had a profit in two consecutive years, according to president Russell T. Dykes.

Colonial sent to its stockholders a recommendation that they approve the proposed merger with Eastern Air Lines. The sale is based on an exchange of two shares of Colonial stock for one share of Eastern.

Trans World

Trans World Airlines reports revenues of \$133,671,000, an increase of 9% over 1953. Domestic revenues were \$145,239,000 and international revenues \$58,432,000. Net income was \$10,366,000, more than double 1953's. TWA says that the 1954 operations were free of any serious loss divisions. The carrier had increases of 11.1% in revenue from last year while operating expenses increased 2.6%. Total operating costs per ton-

nale of service were at the lowest level since 1949.

TWA expects 1955, its fourth anniversary, to show continued improvement. The Time Pay Plan and Sky Train service are viewed by the carrier as important tools in boosting air domestic and international revenues.

The report also contained recognition with the Post Office Department in the surface-mail-in experiment. "We are fully convinced," said R. S. Denson, TWA president, "that the public interest requires dispatch of all long-distance domestic letter mail by air as in the very near future."

Eastern

Eastern reported a net income of \$7,152,032 for 1954, compared with \$7,923,167 in 1953. Total revenues for last year were \$99,597,061, an 18% increase. Earnings in 1954 include \$178,221 in equipment costs of \$1,028,835 from 1953 equipment sales.

Eastern attributed 1954 revenue gains to aircraft operations. Expansion last year increased coach revenues 75% to \$56,418,891, while a 95% gain was registered in passenger carrier. First-class passenger ticket showed a 7% increase, but first class revenues declined from \$311,230,275 in 1953 to \$311,114,169.

Forecasting increases in fares, EAL's Captain Eddie Rostkowski pointed out that fares have increased 34% in 15 years while wages have increased 128%. "More than any other single factor," he said, "the CAB's institution of this critical fare problem would accelerate the local expansion of air transportation service to meet the increasing public road and, at the same time, greatly strengthen the air transportation industry as a valid arm in the case of national defense."

Western

Western Air Lines listed total revenues of \$24,682,779 last year, compared with \$21,878,797 for 1953. Net income for 1954 was \$1,458,699. Introduction of additional DC-6Bs to service, especially in the de luxe "California" flights, is viewed by Western as a key contributor to increased revenues. Airline is WAL's new "Charge-A-Flight" plan which offers credit services to frequent users of the airline.

Western also is planned with coach operations, which accounted for 31% of passenger revenues, compared with 13% in 1953.

Tuross C. Donahue, WAL president, said stockholders that expansion of Western as a regional carrier has come increasingly evident as the line transcontinental carrier concentrates on long haul business and transcontinental intermediate cities. He predicted gains in all types of traffic in 1955.

Continental

Continental reported revenues of \$12,119,884 and expenses of \$11,077,737 for 1954. Net income was \$10,936 or \$1.31 per share. Revenues increased 4.4% over 1953, while expenses rose 4.9%.

Continental integrated operations with Pioneer Air Lines April 1, and the new company expects greater progress toward self-sufficiency with their own scheduled flights.

President Robert J. See explained that 1955 is "the probable year for the inauguration of some service over the Denver night stoppage service that will operate at a lower cost per seat-mile than any other flying domestically to date."

North Central

North Central had a net profit of \$11,707 in 1954, compared with a loss of \$118,588 in 1953. Last year's revenues amounted to \$5,824,043 and expenses were \$5,637,261.

The local carrier reported revenues 21% in 1954 while traffic rose 26%. Encouraged by traffic increases of 45% in January and February, 1955, the company expects substantial gains toward self-sufficiency this year.

Piedmont

Piedmont ended the year with net income for airline operations of \$196,792, income from other divisions being the net to \$287,379 before taxes and \$17,866 after taxes, compared with a loss of \$23,473 in 1954. Airline operating revenues were \$6,908,612.

Piedmont carried its southern gateway in 1954 and carried 368,393 passengers during the year. Traffic gain for the year amounted to 14.5%.

Northwest

Northwest had a net income of \$2,203,144 on revenues of \$65,591,812 in 1954 compared with net income of \$1,770,101 in 1953. Revenues were down slightly from the 1953 figure of \$66,149,827. Northwest operated a military route in 1953 which made the

difference. Commercial revenue accounted \$14,448,413 in 1954.

Northwest was free of debt at the end of 1954, although bank credit has been used since then for purchase of new equipment. The company acquired three DC-6Bs last year, bringing the total to seven. Four Super Constellation are being added to the fleet that spring for use in international operations.

The Northwest report shows that the carrier received \$268,000 in subsidy in December, 1953 and \$62,434 in December 1954, a 76% decline. Increased

international and volume enabled NWA to operate free of subsidy in February, 1955.

Allegheny

Allegheny Airlines reports revenues of \$4,797,894 and expenses of \$4,263,221 for 1954. Net income was \$40,875 compared with \$1,875 in the previous year.

Income increased 35% last year to \$42,564,823 passenger-miles. Purchase of three Martin 202B's is expected to contribute to growth in 1955.

PAA's Trans-Atlantic Traffic Gains Credited to Super Stratocruisers

Trans-Atlantic nonstop capability of the Boeing Super Stratocruiser is giving the Pan American World Airways a significant edge in passenger appeal on the high competitive route, PAA officials now claim.

The new service has come through the first winter of operation with a complete record of 70%.

Pan American has long sought a new service for first class service on the North Atlantic run that could fly the service nonstop. The Stratocruiser has been regarded as the airplane with the greatest passenger appeal from the standpoint of luxury service, so last year Pan American decided to modify it.

777 feet to give it nonstop capability.

► **Modification Program**—Last fall, modification was begun, and the job was completed in February. Two airplanes were affected.

The modification carried two stages. ■ **First** was a pair of basic changes which called for Civil Aeronautics Administration approval. Pan American and the Boeing Airplane Co. expected a modification of the strain gear to increase the fuel capacity by 360 gal.

■ **Second** was an engine modification consisting of the installation of the GM-1 turbo-propellers, which was developed in conjunction with Boeing



Lufthansa Resumes Operations

West German's Lufthansa resumed its operations after the first time since 1944 as the carrier's flag was raised May 31 at Hamburg and one of its four Constellation aircraft took off on a special flight to Munich-Regensburg. Lufthansa service started next day.

and General Electric, IAW Dec. 5, 1974, a 301 that changes were authorized by the FAA.

In addition to these changes, FAA followed a program of minor modifications, including aerodynamic improvements, better engine cooling and more attractive artwork.

► **Range Extended.** The chief result of programs on extension of range is 2,940 nautical mi., an increase of 500 mi.

Modifications resulted in a net weight reduction of 100 lb., but increased fuel load more than doubled that weight improvement, so there was no increase in gross takeoff weight. Speed was increased about three knots. A gross of 2,500 ft. was made in more than 100 ft. of altitude, a 10% improvement over the 17-48,000 ft. range.

These modifications enable FAA to schedule 12 weekly eastbound nonstop flights between New York and London and from Washington flights on all nonstop.

Two American figures as completion record would have been better if some tests had held up, but they were about 10 knots under the seven-year average, an important factor in a long-range operation.

Such things as wind velocity and careful load balancing are vital in the success of the nonstop operation.

Modifications have also increased fuel efficiency.

Two American calls the operation a success and is increasing flight frequency this summer. Actual results are hard to assess, but figures for January and February show the year show an increase of 14% in the number of flights. The North Atlantic traffic will compete with home routes. The nonstop feature is given most of the credit.

TWA's Dumbo Predicts Higher Airline Profits

Business of the kind is narrowing airline profits means this year is predicted by Trans World Airlines President Robert H. Dumbo.

"No guess at that 1975 will result in higher net profit for the airline industry than last 1974, which was the first year to show a reversal of declining earnings since the peak year 1971," Dumbo told a meeting of the New York Society of Security Analysts.

Dumbo pointed to the growing air transport market as the key factor in air transportation, and that, and it would continue to be an airline view. "We believe the profit picture for the traffic was, and is for the future," he said.

"Unfortunately, the price is even more pronounced, with taxes raised, in fact, the standard, and first class considered luxury travel.

CAB Equalizes Pacific Mail Pay

The dispute over the Great Circle route to the Orient has taken another turn, this time as a Civil Aeronautics Board order forcing trans-Pacific mail pay.

CAB has ordered Northwest Airlines and Pan American World Airways to show cause why a standard trans-Pacific airfare should not be established for mail pay purposes. The Board has decided that the Post Office Department doesn't pay the carriers for trans-Pacific mail services on the basis of Northwest's Seattle-Anchorage-Cold Bay Tokyo route of 5,075 mi.

The move that the Post Office Department paid for a 5,075 mi. trip that actually takes 6,688 mi. on the PAA's central Pacific circuit. The rate of 50 cents a ton-mile is standard for both carriers.

► **Equalization Attempted.** The move is the second step in a Pacific mail pay fight. The Post Office Department decided to ship its mail by commercial carrier. Later, President Eisenhower ordered decision on PAA's bid for the Great Circle route when he offered the trans-Pacific route (see IAW Feb. 24, p. 12).

In past years a heavy balance of mail has gone to Northwest because of increased capacity and the fact that its charges to ship it by NWA's. Since then, the competition has been fiercer, the new mail with the shortest route to Tokyo can offer the cheapest service. Northwest's rate is 1,610 mi. shorter than Pan American's.

The Civil Aeronautics Board is attempting to equalize the two carriers so the Post Office will distribute mail between the two carriers with the maximum freedom in its operations, giving sole consideration to the service and capacity.

USAF's T34 Connie

Los Angeles-based USAF turboprop-powered Super Constellation was the model flight test work from Lockheed Aircraft Corp.'s Lockheed plant. As the flights of the T34-11T were not pilots Ray Meschino and Joseph F. Ware. The aircraft was the first of two T34-11T's the Air Force has on order. Turned by Pratt and Whitney T34-11T, 2,000 hp, it has a max weight of 114,000 lb., landing weight is given as 111,500 lb. with a landing speed of 104 mph. Two Navy turboprop Super Constables, K7V-1, clearly are flying.

offered by the carrier in determining the appropriate distribution of mail between them.

► **Compensation Aids.** The rubric that applies to mail traffic between both San Francisco and Seattle and Tokyo. Pan American's efforts to obtain Great Circle routing across the Pacific have received support from the Civil Aeronautics Board. The Board, headed by Rep. Carl Albert, the group has asked the President to give the route to PAA.

In a letter to the President, Hoffman and Ware in California believe that the Civil Aeronautics Board's decision should be a guide. "We should have an opportunity to fly directly on the Great Circle route to the Orient and not be obliged, as we now are, to travel a needless and time-consuming route 1,278 mi. over the coastal Pacific. This is not only an unnecessary imposition upon people in California, but constitutes a heavy burden upon the taxpayers of the nation when they are required to pay for the subsidy needed when passengers and mail are carried over the longer coastal Pacific route."

Tigers Ask Navy To Cut DC-6A Rent

A fivefold increase in air cargo tariffs within five years would be possible if the Navy's program for leasing cargo transports to commercial carriers is adopted. J. L. Barwell, vice president of the Navy's cargo program, said.

Barwell's views were presented at a meeting of industry and government representatives held by an Air Commanding Committee. Purpose was to explore the possibility of continuing the Navy's program (IAW Feb. 25, p. 56).

A rental of about \$15,000 per month for a DC-6A was proposed which would include insurance and maintenance. "If the Navy's cargo program is continued, cargo contractors charged in the open market whose equipment is needed for special or stop-gap purposes the objective will not be isolated because rates will not be lowered sufficiently to start the usage swing of lower rates, lower rates greatly affect and cause airplanes," Barwell said.

► **Reduction Requested.** PTL's bids for leasing a \$12,000 per month reduction from the \$18,000 now being charged. The Navy's cargo program is expected to be limited to two factors. Because the whole effort period from seven to 15 years and administration by the Navy.

Barwell pointed out that the DC-6A actually is used by 18 to 15 carriers, and so, and the changes should be based on the higher figure. He also said that

in view of the number of planes in use, the Navy should not insist on a lease because the benefit would be less in civil operation. The cost of civil operation would be less even if it is actually as a leasing fund basis. It said.

The Civil Aeronautics Board's decision on the DC-6A for PTL at a 2.5 cent per ton-mile at four charges of \$15,000 per month plus insurance of \$2,100, Barwell said. Averaging 250 hr. utilization month, it cost flying costs being the total to 6.2 cents per ton-mile.

► **Eliminate the Purpose.** The PTL official emphasized his opinion that the Navy should have plans only for the scheduled scheduled services. He said the objective is to stimulate the growth of the whole cargo industry, not to isolate the airplanes should be leased only to scheduled airlines running scheduled air cargo service. Any other criteria would defeat the purpose of the program and could have national implications but possibly under economic aspects.

Industry's comments on the Navy program were also to be submitted in writing to the Navy's working group, which will be an advisory report by end April and a final report May 15. Specific questions relating to implementation of the Navy program for which comment was solicited included:

Can need for additional cargo lift be justified?

What financial and lease terms would be recommended?

What cost can be leased aircraft be operated and maintained by civil operators?

What reduction in freight rates might be made possible through the introduction of leased aircraft?

What is your recommendation for distribution of available aircraft?

Do you think this program would increase total demand for new aircraft?

DC-7 Gear, Boeing Nacelle Check Ordered

Recent accidents involving a Douglas DC-7 and a Boeing 377 turbofan engine work resulted in Civil Aeronautics Board ordering an inspection of the DC-7 gear landing gear and installation of a nacelle vibration monitoring device on the Stratocruiser.

CABA investigation showed that the same wheel failure on the night side was initiated by fatigue cracks in the radius of the gear facing of the forward and aft upper attachment bolts. A crack, which was the failure of the bolt, was found at the forward main bulk head of the attachment on the left side.

In addition to the monitoring device, a hand inspection of each of 177 Stratocruiser Standard propeller blades in Stratocruisers is required before

each departure from stations equipped to make the inspection at 17 hr. intervals. A check of electrical leakage and resistance of flexor elements is also required prior to the next departure and checks approximately every 65 hr. thereafter.

BOAC, Sabena, BEA Report Traffic Gain

Passenger reports on 1974 on basis of three foreign airlines—British Overseas Airways Corp., Sabena and British European Airways—indicate traffic increases and a very good level of profit.

BOAC

Passenger figures show an operating profit after interest of more than \$2.5 million for British Overseas Airways Corp. for the year ended March 31, according to Sir Miles Thomas, chairman of the corporation.

The report also reported favorable progress on development of the Alouette IV "dumbo" carrier jetliner and the Britannia XL 100 turboprop jetliner.

The "dumbo" project leading edge wings, larger flaps, increased engine thrust and better performance are expected to improve performance in the Mark 4. Delivery is now being scheduled for approximately the end of 1975.

The Britannia XL 100 "has done very well on African trials," Thomas said and BOAC expects to introduce it into service next year on the South African operation.

BEA

British European Airways anticipates that fuel figures will show that the year ended March 31 will be "by far the best yet for both financial and operating results," Peter Blackford, chief executive of the corporation, announced a profit of over \$7,000,000 more than the previous year.

BEA also reported these increases: traffic up 18%, revenue up 14%, revenue passenger carried, up 12%; revenue passenger miles flown, up 20%; passenger load factor, up 5%. He said costs down 16%.

Sabena

Sabena Belgian World Airlines announced a general traffic increase of 13% in 1974 over 1973.

The company reported these increases: 44% in the number of passengers carried, 18.5% in the passenger revenue, 13.1% in total tonnage, 23.6% in freight tonnage, 15.6% in mail tonnage.

7-year Certificate Up For Local Texas Line

Renewal of the certificate of Texas Texas Airways for seven years and adjustment of local routes in Texas is recommended by Civil Aeronautics Board Examiner Walter W. Brown.

A long period of certification will not only certify Texas Texas Airways, but to develop traffic in the area but to continue diligent efforts improve its Texas civil position while it can replace its modernize its present equipment when required. Brown stated.

Adjustments of Texas Texas routes proposed would include 1,100 one-way miles and add 100 one-way miles, with a total of 1,200 one-way miles.

The common estimates that changes in the carrier's routes would cost less than \$60,000.

Brown also recommended a new route for Continental Express Air Lines between Ft. Worth and Dallas to Pross, North-Haven, Fort Stockton, San Antonio, Brownsville, Corpus Christi, and El Paso. The route is to be operated by Continental Express Air Lines and the Airline is to be operated by Continental Express Air Lines.

Navarho Nav-Aid Will Undergo ARDC Test

Navarho, a five-engine, conventional-tail turbo-prop aircraft with a range of 2,500 to 3,000 mi., will have its first test certification at Grand Canyon, N.Y., under support of USAF's Air Research and Development Command. The Navarho is a five-engine, conventional-tail aircraft, as was boarded by the West Coast and the Aeronautics and Astronautics and the Civil Aeronautics Board.

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Chicago's Midway Nation's Busiest Field

Chicago's Midway Airport led the nation in aircraft movements in 1954 for the third straight year with 349,363 arrivals and departures.

Civil Aeronautics Administration also reported the following year totals in the leading ten civil and military airports: Los Angeles, 279,650; Miami, 268,889; Honolulu, 266,353; Los Angeles (McClellan), 236,017; Denver, 235,362; Cleveland, 222,744; Dallas, 215,685; Atlanta, 213,674; Louisville (Bowling), 210,587.

Excluding purely local operations, Midway Airport was ahead with 150,877 operations for its civilian and domestic and military aircraft. The following cities by number of movements in this category were: New York (La Guardia), 123,098; Washington National, 109,498; Los Angeles, 106,558; Dallas, 105,943; San Francisco, 103,818; Cleveland, 103,810; Miami, 100,985; St. Louis, 104,009; Atlanta, 104,270.

CAA reported control tower handled 179,944 flights in 1954, a 7% gain over 1953. CAA also reported control tower and radar approach control centers recorded 16,865,579 fix positions in 1954. This reflects the air traffic volume along airways between major terminal points.

Air Links Pakistanis

(McGraw-Hill World News)

Dacca, East Pakistan-Pakistan International Airlines' 70-passenger Lockheed Super Constellation is carrying full loads on PIA's new service between Karachi and Dacca.

The 3,500-mile route is the country's first and only direct link between East and West Pakistan. PIA operates four round trip flights a week on the Dacca-Karachi service.

Access to establish air travel is hindered by the government's subsidies over ticket purchases. Cost now runs from only 10¢, compared with the actual price of \$100. When the subsidy is fully phased out, the subsidy will be substantial.

Interlocking relationships between North and South America and the Caribbean is a director of Northwest and the Pan American Transportation Co.

Agreements among Continental Air Lines, Trans World Airlines and various other air carriers to investigate between the companies.

ANTHROPOLOGY
Anthropology Survey Ltd. to conduct an extensive ethnographic survey of the areas in Mexico, Guatemala and Honduras by late July 1955.

Aviation America Ltd. to conduct an extensive

supersound survey in Minnesota before May 15, 1955.

ANNOUNCED

Florida Air Lines' certificate to include Guatemala, Galt, is an intermediate point between San Diego and Santa Ana, Los Angeles.

Los Angeles-Denver-Midwest Airlines a temporary suspension to serve White Plains, N. Y., to include Ohio Route, Dayton, Rochester and Buffalo.

Lines American-Venezuela's foreign air carrier permit to establish the Dominican Republic for Havana in a pact between Managua, Venezuela, and New York, and add Cuba in a pact between Managua and Miami.

ORDERED

Albany Airlines' mail routes to be fixed at the proposed rate for the new ending May 15, 1955, and other Albany's temporary mail routes to effect mail and rates are fixed.

Investigation and suspension of certain scheduled lines fixed by Texas Carriers Airway.

DISMISSED

Complaint filed by Northwest Airlines and Pacific Northern World Airways against a Pacific Northern Airlines proposal to sell the company, has been dropped.

United Air Lines' complaint against a law proposal of Capital Airlines, since the latter company has been dropped.

General Services Administration's petition for leave to advertise in the Chicago Detroit Route 7 Local Service Case, since the petition was not filed in time.

Application of John W. Wilson and Pilot Airways for approval of interlocking air travel, since the relationship no longer exists.

DENIED

Colonial Airlines' application for a temporary certificate to serve White Plains, N. Y.

SHORTLINES

►Aviation, Colombia National Air Lines, reports gross income of \$13,198,160 in 1954. Net profit after taxes was \$3,840,884, \$1,182,000 of which will be distributed as dividends.

►KLM Royal Dutch Airlines has concluded an agreement with European Air Transport to offer a series of 24 buses of the company's air motor coach from KLM arrival points.

►New York Airways is the first scheduled all helicopter airline to become a member of IATA. NYA adds its five helicopters to twenty others operated by IATA members in addition to flying emergency services.

►Pan American World Airways has continued its flight from Mexico, Central American and Panama to Miami, Fla. Pan Am can apply only to traffic between Mexico and points north.

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AMERICAN AIRCRAFT CORPORATION	68	NEW YORK AIR SERVICE	98
AMERICAN AIRCRAFT CORPORATION	69	NEW YORK AIR SERVICE	99
AMERICAN AIRCRAFT CORPORATION	70	NEW YORK AIR SERVICE	100



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CAB ORDERS

(Mar 24 to Mar 30)

GRANTED
North Central Airlines a temporary ex-emption to engage in local air transportation between Detroit City Airport and Willow Run Airport, Detroit, Mich.

The Flying Tiger Line an exemption to perform a flight from Munich, Germany, to New York on or about May 26, 1955, pursuant to a contract with the International Civil Aviation Commission for European Migration.

The Flying Tiger Line an exemption to perform a charter flight from New York to London on or about June 1, 1955, and return from Amsterdam or Dordrecht to New York on or about June 2, 1955.

United Air Lines' application to continue suspension of service of Rapid Springs, Wis., until 60 days after final decision on the Pine Bluff National Case.

Northwestern Airlines an exemption to engage in all transportation of persons, property and mail between Cold Bay, Alaska, and Tokyo, until Apr. 1, 1956.

Pan American World Airways an exemption to serve Hilo, Hawaii, and Kona, Hawaii, on or May 1, 1955.



Engines Run Cooler

Streamlined propeller spacers and rotating seal assembly lessen temperatures of Wright Turbo-Charged engines on Douglas DC-7 about 300° for a given crew fuel air mix. Development, especially benefited as hot days, was worked out by Douglas engineers and will go on DC-7B and DC-7C transports. The manufacturer also plans to offer the seals in lot form in case of engine model DC-7C can make the modification.

Wilson's News Freeze

A new effort to bring order out of the chaotic Pentagon information services has been made by Mr. Charles E. Wilson, Secretary of Defense, with his March 29 directive No. 52309 and its accompanying memorandum to the secretaries of the Army, Navy and Air Force. This is none because Mr. Wilson has long been recognized as the unofficial president of the Pentagon "Trot in the Mouth" Club. He has more public relations bones to his credit than perhaps any other politician of that concrete race.

Nobody, who has had experience in Washington, would argue with Mr. Wilson on the need for a more effective military security system, a more consistent Pentagon policy on new weapons information, and more speed and honesty in providing the press and the public that it serves with accurate information on military activities. There is not a single Congress in the secret industry that has not been paralyzed at one time or another by the lack of these characteristics in the Pentagon public information activities.

However, it seems unlikely that Mr. Wilson's directive will attain these desirable goals. Immediate effect has been to virtually freeze the flow of information through normal military channels to press and public. If these directives continue to be enforced it appears likely that the only avenue from the Pentagon will be a "canned, pre-digested purr line" more in keeping with the insincerity of a dictatorship than with the free discussion of a democracy.

There appear to be three principle flaws in Mr. Wilson's approach to Pentagon public relations:

- The three-day cooling off period for all Defense Department information. This apparently is aimed at giving Mr. Wilson and his personal aides time to digest proposed releases but it is highly impractical since most news of any importance will not keep for three days on any government official's desk. Events move too fast for this proposed delay. Mr. Wilson would be better advised to accelerate the pace of his public relations department rather than try to retard the press.

- The "log" process slipped on all military civilian Defense Department personnel in their public writings. The directive states "each document and review by the Secretary of Defense" shall be released not only to a determination of whether the release of material would involve any technical or substantive violation of security but also to a determination of whether release or publication of the material would constitute a constructive contribution to the primary mission of the Defense Department." Nobody in the Pentagon has yet rendered an official decision of what a "constructive contribution" actually is.

- Replacement of the military public information division in each service with three \$14,800-a-year civilians. This appears to be adding an unnecessary link in the already complicated chain of communication between the military and the public. With few exceptions the civilians assigned to Pentagon public relations jobs are not top flight, and they know little of military affairs. There is strong indication that these new jobs would

be merely more political pawns.

This action also implies that the military public information chiefs have been responsible for the rash of Pentagon publicity boners. This is hardly the case. Most of them can be easily traced to the dozen or top level military and civilian Pentagon brass and not to official public information channels. Also it seems to be more important to have a small but effective group of military people educated on public information than to create a ton of political petrograph jobs.

We predict that before long the Wilson directive will successfully fade away in some manner that former Defense Secretary Louis Johnson's similar effort experienced. Any attempt to impose a gag on full and free discussion of American military policy and to prevent the public from receiving adequate information on the defense effort will not survive long.

In the meantime we recommend the secret industry to follow the guidelines of Pentagon public relations policy closely and to guard vigorously any cases when they are made victims of arbitrary or inconsistent misapprehensions.

Anytime Wines would like to hear about any examples of unfair treatment of aircraft from the Pentagon officials.

More California Coverage

Aviation Week has enlarged its West Coast bureau, by the addition of Irving Stone, a veteran staff member and a senior engineering editor. He will work with William Conklin, West Coast editor, who heads the Aviation Week bureau in Los Angeles.

Irving Stone's assignment to the West Coast bureau will do two things for Aviation Week readers:

- It will expand and improve the engineering coverage and technical news reports that are an outstanding feature of our editorial content.
- It will emphasize the importance of that major segment of the U. S. airplane, engine, missile and aircraft business on the West Coast.

Stone has built a solid reputation for accurate technical reporting during the past decade with his published works in *Aviation Week* and its predecessor, *Aviation magazine*. He holds an engineering degree from the Polytechnic Institute of Brooklyn and has a Doctor of Jurisprudence degree from New York University. For five years during World War II he held supervisory posts with the Army Air Force Technical Training Command, including supervisor of training literature at the AAF Technical School, Chuteau Field, Ill., assistant chief instructor, AAF Technical School, Persimmon Johnson Field, N. C., and administrator of planes and training for the AAF Engineering Cadet School at Yale University. He has been with McGraw-Hill Publishing Co. since 1944 when he joined *Aviation magazine*. He also was engineering editor of *Air Transport magazine* and has been technical editor of *Aviation Week* since its founding in 1947.

—Robert Hite

SPERRY DEVELOPS MEGAWATT KLYSTRONS

Super-Power Tubes Open Way to Electronic Advances

The giant tube you see illustrated here is the first Megawatt Klystron ever built for military use. It is also the first of a series of Sperry Klystrons producing millions of watts of precisely controlled radar power. Developed by Sperry and the Air Research and Development Command primarily for defense purposes, its capabilities indicate that potential uses are virtually unlimited.



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IN GUIDED MISSILES... Sperry's new Megawatt Klystrons make possible more accurate control of missiles permitting greater over longer paths.



IN ATOMIC ENERGY... Sperry's new Megawatt Klystrons provide stable driving power for longer about accelerators and high energy X-ray devices used for scientific research.



Look out hell the Red Megawatt Klystron. Another developed for military purposes by Sperry, develops 1,000,000 watts of power up to 45% efficiency and 20 to 200 GHz. Other Megawatt Klystrons are now in production.

FOR FURTHER INFORMATION: Qualified organizations can receive information on these super-power tubes to aid in electronic system design by writing to our Sales and Electronic Department.

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